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Adaptive architecture for command and control (A2C2) Experiment 11 determining an effective ISR management structure at the operational level of conflict

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THESIS

ADAPTIVE ARCHITECTURE FOR COMMAND AND CONTROL (A2C2) EXPERIMENT 11: DETERMINING AN EFFECTIVE ISR MANAGEMENT STRUCTURE AT THE OPERATIONAL LEVEL OF CONFLICT

by

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June 2008

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This thesis on Experiment 11 concentrates on two conditions of the main independent variable: the position of the ISR Officer. Analysis compares different performance variables under the two ISR role structures. Condition I is comprised of an ISR Coordinator (ISR Coord), a Sea Combat Commander (SCC) and a Marine Expeditionary Unit Commander (MEU). Condition II is comprised of an ISR Commander (ISR Cdr), an SCC and a MEU. Both ISR Officer conditions are examined in a HA/DR scenario. The assessment of performance includes responsiveness of the two conditions when assets are reduced. Participants were asked to plan for the allocation of ISR assets and then re-plan when assets were reduced. Thus, this experiment also examines the simulator as input for operational-level planning.

This thesis also compares the findings from Experiment 11 with the findings from Experiment 10 to determine if the ISR management structure, reduction in assets and incorporated planning process in Experiment 11 to determine how the ISR management structure in Experiment 11 affected the utilization of ISR assets.

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ADAPTIVE ARCHITECTURE FOR COMMAND AND CONTROL (A2C2) EXPERIMENT 11: DETERMINING AN EFFECTIVE ISR MANAGEMENT STRUCTURE AT THE OPERATIONAL LEVEL OF CONFLICT

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I. INTRODUCTION

A. OVERVIEW

The Adaptive Architectures for Command and Control (A2C2) program is sponsored by the Office of Naval Research (ONR). The work of Experiment 11 was led by researchers from the Naval Postgraduate School, with support from Aptima and the University of Connecticut.

The A2C2 research program has focused on helping to define adaptive command structures for future joint and combined forces. In particular, A2C2 Experiment 10 investigated efficient structures for C2 of intelligence, surveillance, and reconnaissance assets in an Expeditionary Strike Group (Kennedy, 2007). The current work revisits some of these results with further human-in-the-loop experimentation.

B. PROBLEM

The challenge in today's range of defense operating environments is designing a C2 organization that is able to multi-task in a high tempo operations without losing resources. In Bestoso (2005) it was determined that military organizations require C2 structures to facilitate effective wide range coordination and efficiency in mission performance.

Bestoso (2005) conducted research on the capabilities and nominal tasks of an Expeditionary Strike Group (ESG). The focus of analysis was the consideration of human skills and abilities in decision-making in conjunction with planning cycles to adequately model a command and control organization. ESG was a new concept accompanied with uncertainties pertaining to anticipated actions and missions in command and control. The research concluded that the ESG was able to conduct joint operations with the navy, manage assets and

perform missions. Although it appears that the ESG is capable of multi-tasking, often times they were overwhelmed with tasks, which in turn stressed the capacity of decision makers or assets.

C. SCOPE

Examination of ESG operations indicates that they are a combination of special operations, humanitarian assistance, maritime security operations and peacekeeping operations. These operations are heavily dependent upon ISR assets that are often spread across component commanders and are multi-tasked. This makes the ISR mission the ideal candidate to test the different C2 structures that might address many of the problems found in Bestoso (2005).

A2C2 formed its first relationship with ESG in 2004. During that time, Admiral Michael LeFever was selected to command ESG-1. Adm LeFever established communications with the Office of Naval Research (ONR) to request the A2C2 and CMD 21 programs to advise the development of adaptive C2 architectures for his ESG. The initial studies focused on structures and processes related to both planning and operations that an ESG would participate in either as a stand-alone force or as part of a JTF. In 2006, data were gathered from ESG personnel and from observing ESG operations for the purpose of future scenario building for future A2C2 laboratory simulation experiments (Weil, et al., 2006). The following organizational challenges were identified: establishment of an ISR Commander/Coordinator; management and allocation of limited assets over many possible missions; and synchronizing planning cycles.

The A2C2 research group staged Experiment 11 to respond to the challenges listed above. Experiment 11 was designed with two management structures, Condition I and Condition II. Condition I is comprised of an ISR Coordinator (ISR Coord), a Sea Combat Commander (SCC) and a Marine Expeditionary Unit Commander (MEU). The ISR Coord does not own any ISR assets, but takes an active role in de-conflicting asset scarcity problems, monitoring tasks to assure periodic updates and assessments are current,

coordinating with SCC and MEU, monitoring e-mail and intelligence messages and striving for efficiency in the use of ISR assets. Condition II is comprised of an ISR Commander (ISR Cdr), a Sea Combat Commander (SCC) and a Marine Expeditionary Unit Commander (MEU). The ISR Cdr controls high-value ISR assets (UAVs), monitors ISR taskings from higher authority, coordinates with SCC and MEU, monitors e-mail and intelligence messages and strives for efficiency in the use of ISR assets.

The A2C2 research team evaluated the performance of seven teams in both ISR Officer conditions in an HA/DR scenario in which assets were reduced. Four teams performed in Condition I and three teams performed in Condition II. The post-experiment analysis results were compared with expected results from Experiment 11 and results from Experiment 10. Participants were asked to plan for the allocation of ISR assets and then re-plan when assets were reduced. Thus, this experiment also allows for the evaluation of the simulator as input for operational-level planning.

D. CONTRIBUTIONS OF THESIS

The work conducted in this thesis contributes to the foundation of discovering more efficient ways for command and control of ISR assets. Modern advanced technology is making progress in the ISR field creating a greater demand on ISR assets. It seems every commander now requires real time coverage of his/her Area of Responsibility (AOR). This requirement has exceeded the current ISR asset supply. In order to satisfy this demand new, innovative methods of managing primary and secondary ISR capabilities must be discovered. The DDD simulator with its established and detailed scenario design work is an ideal system to perform experiments utilizing various Command and Control structures to determine which structures contribute to ISR asset management efficiency.

A further contribution is the demonstration of the ways in which the DDD simulator may be utilized as a training tool by military units. Having worked out

the intricate details of how to incorporate assets, tasks and units into the DDD scenarios, it would be an uncomplicated matter to manipulate these attributes and customize the simulator to fit unit specific training requirements. The DDD simulator can be customized by entering a unit's ISR structure, assets and tasks to train units for specific missions past, present or future. DDD may be utilized as a training tool for all services.

Finally, this thesis and Experiment 11 also examines the simulator as input for operational-level planning and can contribute a wealth of data to be analyzed in the future about teamwork and the planning process. Further analysis options are detailed in Chapter V, Recommendations for Future Experiments.

E. SUMMARY OF THESIS

Chapter II provides a historical background on Command and Control, DDD Simulation and A2C2.

Chapter III lays a detailed description of the conduct of Experiment 11.

Chapter IV provides an analysis of the results from Experiment 11 and compares them with expected results and results from Experiment 10.

Chapter V summarizes the thesis, provides recommendations for future experiments and concludes the thesis.

Appendices contain all documents utilized in the experiment and data figures of data analysis.

II. HISTORICAL BACKGROUND

A. OVERVIEW

The A2C2 program utilizes model-based experimentation to examine alignment and adaptation of Joint Command and Control management structures to mission requirements. This experiment evolved from the previous ten experiments. Experiments 1 and 2 studied the interaction between task structure and organization structure. They described a process for developing military operational scenarios within a task structure context. Experiment 3 focused on how organizations adapt their structures to maximize their effectiveness under changing events. Experiment 4's goal was to further investigate the results of Experiment 3. Experiment 5 utilized Marine Air Ground Task Force (MAGTF) Tactical Warfare Simulator (MTWS) to re-examine selected research questions from Experiment 4 and focused on the performance of Joint Task Force decision-makers in model based and traditional Joint Task Force (JTF) architectures. Experiment 6 was a transition event where A2C2 concepts and methodologies were applied to actual operating forces. Experiment 7 involved the introduction of complex, unexpected tasks requiring multi-node coordination into the simulation scenario and the examination of two disparate command and control architectures in dealing with these unexpected tasks. Experiment 8's objective was to study the adjustments that organizations make when they are confronted with a scenario for which their organizational structure is ill-suited. Experiment 9 provided insight into the challenges faced by an organization in the process of adaptation and factors that affect the willingness and perceived need for adaptation. Experiment 10 focused on developing an effective and efficient C2 structure to support and utilize the increasing ISR capabilities being employed by Navy/Marine Corp Expeditionary Strike Groups. While Experiment 11 continued the examination of ISR management in an ESG, it also was intended to lay the

ground work for future A2C2 experiments dealing with operational-level planning for organizations such as Maritime Headquarters with Maritime Operations Centers (MHQ/MOC).

B. COMMAND AND CONTROL

Command and control is the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Its functions are performed through an arrangement of personnel, equipment, communications, facilities and procedures employed by a commander in planning, directing, coordinating and controlling forces and operations in the accomplishment of a task. (JP-1)

There are many different areas that play a role in command and control. Organizational structure is one of the most important, due to the obstacles leadership encounters. The challenges for effective command and control are not surprising due to the growing requirements since 1939. This growth is due to (Van Creveld 1985): 1)increased demands made on command systems by present-day warfare; 2) technological developments that have multiplied the means at the disposal of command systems; 3) changes in the nature of the command process, resulting from the interaction of factors 1 and 2; 4) the appearance of new weapons systems that, when coupled with structural changes inside command systems themselves, have increased the vulnerability of command systems; and 5) the rise in costs, caused by factors 1 through 5

Although command and control has evolved from Stone Age chieftains and commanders on horses to commanders in command centers, it still remains that effective command and control allows decision makers to optimize available assets. Command and control recognizes the continued increase in capabilities of personnel, technology and processes. If properly coordinated they allow for effective decision making.

C. DDD SIMULATION

Distributed Dynamic Decision making (DDD) was developed jointly by University of Connecticut, Naval Postgraduate School (NPS) Monterey and Aptima. The first version (DDD-I) was incorporated over twenty years ago and utilized from 1984-1989; DDD-II 1989-1994; DDD-III 1994-2008; and DDD-IV 2008. DDD is funded largely by the Office of Naval Research A2C2 program and captures the functional relationship of team dynamics, organizational structure, asset capabilities and task requirements. DDD has been utilized in over thirty five experiments by NPS and other navy/Department of Defense (DoD) organizations. It is an empirical research tool for lab-based experimentation for the study of command and control in varying operational conditions (Kleinman, 2008).

D. A2C2

Sponsored by the Office of Naval Research (ONR), the Adaptive Architecture for Command and Control (A2C2) program utilizes model-based experimentation. The objective of the A2C2 program is to support military forces by looking at innovative joint command and control management structures that are adaptable and meet the rapid changing demands of changing adversaries and missions. The A2C2 research program also integrates optimization, modeling and simulation-based research efforts with psychology-based and experimental activities. Naval Postgraduate School’s emphasis is on evaluating model-based organizational designs through human-in-the-loop experimentation (Hutchins, et al., 2007).

E. HISTORICAL BACKGROUND

The proliferation of ISR assets within an ESG creates a challenge for efficiently commanding and controlling those assets. Every ESG Commander has his own method of overcoming this obstacle, but none of those methods are standard procedures or documented in a doctrine for all ESGs to follow. Bestoso

(2005) concluded that with the increased tasking assigned to the ESG and the increased workload that comes with it, a better way to perform the C2 functions is needed in order to reach the ESG's full potential. Kennedy (2007) was inconclusive as to which of the three ISR Officer role structures examined in A2C2 Experiment 10 was more effective; the results were judged ambiguous because of limited data. Entin and Weil (2007) concluded that the most effective of the three levels in experiment 10 was that of the ISR Commander.

III. EXPERIMENT METHODOLOGY

A. OVERVIEW

In Experiment 11, the A2C2 research team conducted a follow-on to prior work to determine an effective ISR management structure at the operational level of conflict by comparing two structural conditions: Condition I contained an ISR Coordinator and Condition II contained an ISR Commander. In addition, the experimental sessions incorporated team planning for the allocation of assets and opportunities for re-planning when faced with a reduced asset situation.

B. FOUNDATION

Experiment 11 is an expansion of Kennedy's thesis from 2007 on the role of the ISR Officer, where three levels of the ISR role existed. Kennedy concluded that there did not appear to be any definitive increase in efficiency or effectiveness with the presence of an ISR Coordinator or ISR Commander on an ESG staff. Experiment 11 was conducted in an attempt to achieve a more definitive answer on the role of the ISR Coordinator and the ISR Commander that Experiment 10 was unable to. This was done by establishing time requirements for re-visit rates, assessment rates and re-assessment rates to establish more definitive measures of performance. Experiment 11 also incorporated planning with a reduction in the number of available assets. By incorporating planning and re-planning, it was a way to transition towards examining operational-level activities in the experimental environment.

C. BACKGROUND

The focus of the A2C2 research program has been examining command structures for future Naval, Joint and Combined forces using model-based simulations and human-in-the-loop experimentation. In 2005, the A2C2 team was asked to investigate the adaptive C2 challenges of an Expeditionary Strike Group

(ESG). The investigation was broken into three phases; Assessment, Comparison, and Optimization. The A2C2 team had two primary goals in this activity. The first was to gather data to give immediate feedback to ESG Commander regarding possible ways to improve adaptive C2. The other was to gather data that would inform the design of a scenario that could be brought into the research laboratory for systematic testing of adaptive C2 issues relevant to the ESG. Seven issues were identified from the preliminary data collection which were then narrowed, with input by ESG staff, to their top three priorities. Of the top three priorities, the A2C2 team decided to focus their efforts on the Establishment of an ISR Commander/Coordinator (Kemple, et al., 2006).

D. INDEPENDENT VARIABLES

For Experiment 11, the A2C2 research team used two independent variables and integrated planning with a reduction of assets. The research questions established for Experiment 11 are:

1) How effective was the management structure at Condition I and Condition II at conducting initial task measurements and revisit task measurements?

2) What impact did the integration of planning and the reduction of assets have on the management structures?

3) Which ISR Officer condition was most effective in completing the assigned tasks?

To answer each research question, players were separated into groups to represent each ISR Officer role. To be able to compare the two roles fairly, each group was assigned the same tasks with set revisit parameters.

The independent variable in Experiment 11 is the role of the Intelligence, Surveillance and Reconnaissance (ISR) Officer. This experiment concentrated on the two conditions of the ISR Officer: ISR Coordinator (Coord) and ISR Commander (Cdr).

Condition I has an ISR Coord who does not own any assets, but can be actually engaged or lead in de-conflicting high demand low density assets, monitoring tasks to assure periodic updates and assessments are current, coordinating with SCC and MEU, monitoring e-mail and intelligence messages and striving for efficiency in the use of ISR assets.

Condition II has an ISR Commander. The ISR Commander controls high-value ISR assets (UAVs), conducts ISR taskings from higher authority, coordinates with SCC and MEU, monitors e-mail and intelligence messages and strives for efficiency in the use of ISR assets.

E. EXPERIMENTAL DESIGN

In Experiment 11, A2C2 researchers compared two ISR management structures at the operational level of conflict. Participants were asked to plan for the allocation of ISR assets and then re-plan when assets were reduced. The two management structures are that of the ISR Coordinator at Condition I and ISR Commander at Condition II.

The participants in this experiment are multi-service members with various job specialty backgrounds, different experiences and different amount of years of service. Each participant was required to complete demographic survey, which provided background information on each participant. There were 25 students, six researchers and four students to perform the duties as monitors. The teams were broken into seven teams of three: A, B, C, D, E, F and G. They were further broken down into the two conditions. Teams A, C, E and G are at Condition II, which is comprised of an ISR Cdr, SCC and a MEU. Teams B, D and F are at Condition I, which is comprised of an ISR Coord, SCC and a MEU. Once students were assigned teams, they were able to decide amongst themselves which role they would take on.

The ISR Cdr responsibilities include taking an active role in controlling high-value ISR assets (UAVs), conducting ISR taskings from higher authority,

coordinating with SCC and MEU, monitoring e-mail and intelligence messages and striving for efficiency in the use of ISR assets. The ISR Coord is responsible for taking an active role in de-conflicting high demand low density assets, monitoring tasks to assure periodic updates and assessments are current, coordinating with SCC and MEU, monitoring e-mail and intelligence messages and striving for efficiency in the use of ISR assets, but does not own any ISR assets. MEU is overall responsible for land operations. This includes the following: 1) maintaining situational awareness of buildings, fishing villages, military ground patrols, refugee camps and truck convoys; 2) locate ground search and rescue and conduct rescue; 3) respond to external ISR tasking; 4) eliminate hostile CDLs and SAMs; 5) coordinate with SCC and ISRC; 6) take action according to ZIPPOs. SCC is overall responsible for maritime operations. This includes the following: 1) maintain situational awareness of fishing boats, merchant vessels, oil tankers and patrol crafts; 2) conduct any at sea search and rescue; 3) respond to external ISR tasking; 4) coordinate with MEU and ISRC; 5) take action according to ZIPPOs.

The experiment was scheduled for two weeks. Week one was to conduct training for familiarization with scenario and simulation software and week two was performing data runs. The schedule appears in Table 1.

					WEEK 1							
Day	**Team**	**Time**	**Run**	**Team**	**Time**	**Run**	**Team**	**Time**	**Run**	**Team**	**Time**	**Run**
Mon	A	0800-0950	Trng	B	1000-1150	Trng	C	1200-1350	Trng	D	1400-1550	Trng
Tues	E	1000-1150	Trng	F	1300-1450	Trng	G	1500-1650	Trng			
Wed	A	0800-0950	1	B	1000-1150	1	C	1200-1350	1	D	1400-1550	1
Thurs	E	1000-1150	1	F	1300-1450	1	G	1500-1650	1			
					WEEK 2							
Day	**Team**	**Time**	**Run**	**Team**	**Time**	**Run**	**Team**	**Time**	**Run**	**Team**	**Time**	**Run**
Mon	A	0800-0950	2 &3	B	1000-1150	2 &3	C	1200-1350	2 &3	D	1400-1550	2 &3
Tues	E	1000-1150	2 &3	F	1300-1450	2 &3	G	1500-1650	2 &3			
Wed	A	0800-0950	3	B	1000-1150	3	C	1200-1350	3	D	1400-1550	3
Thurs	E	1000-1150	3	F	1300-1450	3	G	1500-1650	3			

Table 1. Experiment Schedule

There are four sessions in this schedule. A session can be defined as every time a team is scheduled in the lab. A run is the tempo level of the DDD simulation. Run 1 is less busy and run 3 is the busiest.

In session 1 the following occurred:

1) Participants completed consent forms, 5 minutes
2) Role selection confirmation, 5 minutes
3) Buttonology training following the step by step DDD tutorial; researchers utilized the DDD Training Pointers to Cover During Buttonology Training sheet, 90 minutes
4) Break, 10 minutes
5) Buttonology training without the step by step tutorial, 30 minutes

In session 2 the following occurred:

1) Scenario play run 1 with researchers conducting training, 45 minutes
2) Break, 10 minutes
3) Scenario play run 1 with continued with reduced training guidance, 45 minutes

In session 3 the following occurred:

1) Based on the familiarity with the scenario and mission from session 2, each team was allotted time to verbally plan and discuss plan of attack, 5 minutes
2) Scenario play run 2 with minimal guidance from researchers, unless assistance was requested or participants appeared uncertain in what action(s) to take, 35 minutes
3) Break,5 minutes
4) Conduct verbal discussion of prior performance and any planning adjustments, 5 minutes
5) Scenario play run 3, 20 minutes. Participants were allowed to play run 3 just to get an idea of a now increased tempo

6) Team planning for next session, 35 minutes. Teams were required to complete planning sheets for SCC, MEU and ISR. If teams were unable to complete the planning sheet they were authorized to take them home as homework.

In session 4 the following occurred:

1) Players complete Demographic survey
2) Teams review plan from session 3, 5 minutes
3) Scenario play run 3, 20 minutes
4) Monitors start collecting data at 15 minutes of game play
5) Pause run 3 at 20 minutes of game play
6) Break, 5 minutes
7) Researchers remove assets from simulation during break (MEU: 2 RECC and 1 XH-30; SCC: 1 RHIB and 1 UAV)
8) After break brief players on loss of assets (called to other missions by COCOM) and provide feedback from monitoring sheets on quality of performance and allow players to re-plan, 10 minutes
9) Continue to play run 3
10) Monitors start collecting data at 30 minutes of game play
11) Monitors start collecting data at 45 minutes of game play
12) Stop game at 50 minutes of game play
13) Provide feedback from monitoring sheets
14) Players complete Post-Experiment survey
15) Players complete NAS TLX survey
16) Monitors complete Teamwork Assessment survey

F. SCENARIO DESIGN

1. Environment

Experiment 11 was conducted in a Systems Technology Battle Lab (STBL). The lab is well lit and spacious. Each player was provided a workstation, a player binder, communication capability with each team member, writing utensils and scratch paper. A table with chairs were available for use as well as a large screen display with the operational picture for use during planning. By utilizing the DDD it was not necessary to conduct the experiment in a combat information center (CIC) onboard ship. DDD works as a training tool to prepare personnel for success in real-world missions and captures the functional relationship of team dynamics. The goal in this environment is valid experimentation on Command and Control, not a duplication of operational conditions.

2. Briefing

One week prior to conducting Experiment 11, participants were given a brief on Experiment 11 Adaptive Architecture for Command and Control (A2C2) and an overview of Dynamic Distributed Decision making (DDD) simulation. Participants were already separated into 7 groups of 3 and assigned a management structure, but not assigned a role in the structure.

Experiment 11 A2C2 brief provided participants with the geopolitical situation, status of countries involved, area of responsibility, different management structures, responsibilities of each decision maker, organization of forces (assets and their locations), utilization of the Asset Capability for Measuring Task Attributes sheet and utilization of ZIPPOs.

DDD brief provided participants with a brief overview of the history of DDD and an what to expect in the lab.

Participants were provided a folder with the following items: 1) Experiment 11 A2C2 brief 2) legend of task symbology 3) screen shot of area of responsibility (AOR) 4) asset acronyms 5) Operation Ensuring Hope brief 6) measuring task attribute sheet 7) fishing boat ZIPPO 8) task description. By providing participants with the briefing and resources, this allowed them ample time to review the items at their leisure and clear up any questions they may have had prior to the experiment. Upon completion of the briefing, participants decided which role each participant in the group would assume.

3. Geopolitical Background

The fictitious geopolitical background utilized in this scenario is as follows:

Thirty days ago the country of Asiland was struck by a Tsunami that caused massive damage to the country's infrastructure as well as incalculable losses to her civilian populace. Following the tsunami, a lack of response from the Asiland government to the disaster has resulted in multitudes of Asiland citizens fleeing south looking for help and better conditions. The southern exodus, which was both by land and sea, quickly overwhelmed the meager resources of Asiland. Moreover, when the tsunami hit, Asiland's governance was already more in the hands of terrorist and guerilla/drug cartel organizations than Asiland's elected representatives; this situation has degraded even more since.

As waves of refugees streamed south, they came to realize that real help and assistance was in the neighboring country of Bartola, whose intact infrastructure and strong western ties made it the natural springboard for relief efforts. Within days the guerillas and other terrorist factions in and around Asiland began to take advantage of the situation by migrating their operations to Bartola. These groups openly robbed relief sites and workers, raped and murdered refugees gathered along the coast, and accosted local and international shipping.

The United States was invited by the Bartola government to provide humanitarian and disaster relief assistance to Bartola and the organizations operating within it. ESG-7 based around the USS ESSEX was dispatched to the region to assume these tasks.

ESG-7 arrived three days ago. The vessels of the ESG have spent that time positioning themselves in the waters around Bartola and Asiland and slowly developing operational picture for both the land and sea situations. Major sea and air lanes were identified, as well s several major ports, villages, and cities. The ESG then placed forces where they would best support what the ESG staff believed were their upcoming land and sea operations.

A day after the arrival of ESG-7 Bartola officials reported a large uprising in the southwest area of Bartola. Insurgents, now supported by groups from Asiland have begun to wrest control of the area from Bartola's forces. Bartola's military units shifted to the southwest to counter, but this merely led to a total loss of control of the refugee situation along the northern border. Intelligence suggests that terrorist or cartel forces, supported by dissident groups in Bartola and Asiland, may be making a concerted effort to wrest control of the government. It was also reported that several oil tankers and cargo ships were accosted by local pirates. The government of Bartola has requested United States forces to assist them in putting down the insurgency in the southwest. The United States has agreed, and has deployed the bulk of 31st MEU forces to support Bartola's counterinsurgency actions.

Bartola's military patrols are overwhelmed with tracking and locating the large numbers of refugee boats, as well as locating the terrorist and cartel operatives using refugee boats for illegal transfers. Furthermore, Bartola intelligence shared information that several coastal defense missile launch sites once located in Asiland are missing. Bartola intelligence believes that some of these launchers may have been moved to new locations, possibly, Haven Island. There is also a strong possibility that Haven Island is being used as a pirate base for local terrorist and insurgent groups. Bartola has requested the assistance of

the United States and in assisting with the situation at sea. The neighboring country to the east, Cathal, has neither resources nor the political/military will to become involved or assist in the current situation.

4. Emergent Tasks

Emergent tasks are items that require immediate action. These tasks are sent via e-mail from higher authority to decision makers and include the following: Coastal Defense Missile Launchers (CDLs), SAM sites and ISR mapping. Descriptions of each can be seen in tasks description.

5. Tasks

Tasks are items that require the use of assets to measure their attributes. Depending on the value of all the attributes of a task, will determine the appropriate action for the decision maker to take. There are fourteen tasks in Experiment 11.

At Sea Search and Rescue (SOS) are time critical events that must be dealt with immediately to avoid political, other public relations repercussions or the loss of lives. This is normally a result of a ship having been attacked or having hit a mine.

Buildings (GBLDG) are located along major roads and have the potential to serve as basing stations by terrorists and insurgents. These require ongoing monitoring.

Coastal Defense Missile Launchers (CDL) that have been pirated pose a threat to U.S. and international shipping in the region. CDLs are not considered hostile until designated hostile by the ESG CDR. If the ESG CDR obtains intel showing CDLs to be used against shipping, the ESG CDR shall order them located and destroyed.

Fishing Boats (FB) are vehicles that might transport refugees, terrorists and weapons. These must be monitored for cargo and status (i.e., terrorists).

Fishing Villages (FV), which there are four located on Bartola, are the major points of departure and entry of refugees, terrorists/insurgents (mingled within the refugees) and weapons through the use of the large local fishing fleet.

Ground Search and Rescue (GS&R) are time critical events that must be dealt with immediately to avoid political, other public relations repercussions or the loss of lives.

ISR Requests are pop-up requests from higher authority to conduct a time critical mapping at a specified location.

Merchant Vessels travel the known sea lanes carrying cargo to multiple international destinations. Several merchants deliver relief supplies and unfortunately smuggle weapons to terrorist groups in the country.

Military Ground Patrol (GMGP) are vast and active throughout Bartola. Insurgents and bandits are also moving about the country and may pose as ground patrol.

Oil Tankers transit the sea lanes going to and from oil platforms near Cathal. They are potential targets for terrorist attacks and need to be protected.

Patrol Crafts are utilized by Asiland, Bartola and Cathal. All patrol crafts are subject to being commandeered by terrorists/insurgents, who can use them to do things such as attack merchant vessels or oil tankers.

Refugee Camps, which there are four located in Bartola. They are the location of the greatest relief works being conducted and the ultimate destination of all refugees in the country. There are several of these spread over the countries and islands.

SAM Sites (GSAM). All countries in the region have agreed to deactivate their SAM sites while the U.S. is conducting humanitarian operations. A few mobile sites have been reported stolen and have been commandeered by terrorists.

Truck Convoys transit throughout Bartola to deliver relief supplies and food shipments to refugee camps and fishing villages.

The overall task of the ISR Commander, ISR Coord, SCC and MEU is to measure each attribute of a task and take action according to ZIPPOs. For example, the building task. Buildings have attributes of activity and temperament that require measurement. If the activity of a building is suspicious and the temperament is hostile, then the action is to strike the building with an AV8 or an AH1. If tasks are not completed, it spawns something else to occur. It is important for decision makers to measure all attributes of a task and take appropriate action immediately.

6. Building the Scenario

The goal of Experiment 11 was to determine an effective ISR management structure at the operational level of conflict. It was intended to evaluate how planning could be inserted in the series of simulation events. This latter aspect of the research is in preparation for future A2C2 work with Maritime Headquarters with Maritime Operations Center (MHQ with MOC), which is going to be the new focus for Adaptive Architecture for Command and Control (A2C2) experimentation.

The scenario design modified the Experiment 10 scenario to support the Experiment 11 research goals. This experiment used the same geopolitical background, but utilized slightly different management structures, incorporated planning amongst the decision makers and reduced the assets. This created a larger requirement for asset allocation and coordination.

Researchers spent over 600 hours combined conducting telephone conferences, meetings, DDD training/familiarization and document review/revision. They decided on utilizing two management structures: Condition I, which is made up of an ISR Coord, an SCC and a MEU and Condition II, which is made up of an ISR Cdr, an SCC and a MEU. Some of the

findings reported by Kennedy regarding Experiment 10 along with the research goals of Experiment 11 led to the following scenario design challenges. Each challenge below has a description of how it was resolved.

1) Elimination of skepticism: Researchers wanted to create military realism; but the experimental/simulation context requires that assets be somewhat abstracted. Participant feedback from Experiment 10 indicated one of the problems was skepticism due to the pre-conceived capabilities of assets such as the UH-1 and SH-60. This was resolved by creating the XH30, which is a conceptual (rather than real) advanced multi-purpose helicopter that combines the capabilities of an SH60 and UH-1, and are deployable for both sea and ground missions. Another way of eliminating skepticism was by providing asset acronyms to each player which provided a brief description of each asset.

2) Determining what assets should be lost: Researchers played multiple scenarios, utilizing different combinations of asset reductions. This was done to determine if it was feasible to lose those assets and still perform assigned tasks without players being overwhelmed. In selecting the assets to remove, researchers wanted to ensure decision makers still had assets to provide assistance in performing task measurements for each other's tasks. Using input from A2C2 modelers at the University of Connecticut, the ultimate combination of asset reduction was two RECC, one XH-30, one RHIB and one UAV.

3) Simplifying assets: Assets were combined to reduce the nomenclature and the amount of different assets that had similar measurement capabilities. The UH-1 and SH-60 was combined into the XH-30 and the SOF was combined with RECC.

4) Measurement range: Some ranges for asset measurement capability were changed for ease of manipulation on the display screens. The MSPF measuring capability was increased from three miles to five miles, RECC increased from three miles to five miles and the RHIB increased from three miles to five miles.

5) To eliminate confusion of what tasks to pursue, researchers removed the tasks of airfields and medical facilities. This reduced the clutter on the screen and prevented feeling the need to measure the tasks not part of the current scenario.

6) Reduction of message traffic: Spawned messages and regular messages were reviewed and revised to be more specific and utilize proper military jargon.

7) The help button for each task was updated with information about what attributes were required to be measured. This provided a quick alternative to having to look at the measuring task attribute sheet.

8) Assessment rates, revisit rates and re-assessment rates were captured by performance "monitors" throughout the data collection as a way to determine if tasks are completed or if measurements were conducted at prescribed times.

One of the research questions being addressed was: Does the management structure (ISR Coordinator vs. ISR Commander) affect the degree to which decision makers focus on their "local" goals or encourage communication and cooperation amongst decision makers (i.e., supporting relationships)? This question led to the following aspects of the experimental design:

1) Determination of roles and responsibilities. Roles were determined to be that of the ISR Cdr, ISR Coord, SCC and MEU. Responsibilities were established as ISR's supported the SCC and MEU. SCC was overall responsible for sea tasks and MEU was overall responsible for land tasks. It was determined that although each decision maker has an overall responsibility, coordinated effort was required to successfully complete all tasks.

2) Reduction of assets. Once assets were reduced it required increased coordination amongst decision makers.

3) The incorporation of planning. By incorporating planning and re-planning, it allowed decision makers to maintain situational awareness and ensure they were attentive to ways in which they could support each other in task accomplishment.

7. Assets and Sensor Capabilities

The assets in Experiment 11 were organized as seen in Table 2.

ESG		**SCC**			**MEU**		
Asset	**Amount**	**Asset**	**Amount**	**Location**	**Asset**	**Amount**	**Location**
UAV	4	RHIB	1	DDG	AV8B	1	LHA
		RHIB	1	CG	AH1	1	LHA
		XH30	2	FFG	XH30	2	LHA
		LCU	1	FFG	MSPF	1	LSD
		LCAC	2	LSD	MSPF	1	LPD
		HH60	2	LHA	RECC	4	FOB Bartola

Table 2. Asset Organization

Depending on the ISR management structure, the four Unmanned Aerial Vehicles (UAV) were either owned by the ISR Commander or owned two each by the SCC and MEU. UAV is an aircraft with no onboard pilot. UAVs can be remote controlled or fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. In the DDD UAVs are capable of and measuring specific attributes from ranges of 12 and 15 miles.

Rigid Hull Inflatable Boat (RHIB) is a light-weight but high performance and high capacity boat constructed with a solid, shaped hull and flexible tubes at the gunwale. The inflatable collar means that buoyancy is not lost if a large quantity of water is shipped aboard. The design is stable and seaworthy and is able to measure specific attributes at a range of five miles in DDD.

XH30s are conceptual/advanced multi-purpose helicopters that combine the capabilities of an SH60 and UH-1 and are deployable for both sea and ground missions. In the scenario software, XH30s can measure specific attributes at four and ten miles.

Landing Craft Utility (LCUs) have no attribute measuring capabilities and are used by amphibious forces to transport equipment and troops to the shore. They are capable of transporting tracked or wheeled vehicles and troops from amphibious assault ships to beachheads or piers.

Landing Craft Air Cushioned (LCACs) are transports, ship-to-shore and across the beach, personnel, weapons, equipment and cargo of the assault elements of the Marine Air-Ground Task Force. LCACs do not have attribute measuring capabilities.

HH60s are helicopters with medium-range search and rescue (SAR), drug interdiction, cargo lift, special operations and significant ISR capabilities. HH60s have specific attribute measuring capabilities of four and six miles in DDD.

AV-8 is a Light Attack Aircraft (Harrier). Its primary mission is to provide responsive close air support for the ground forces. This single-piloted, advanced vertical/short takeoff and landing aircraft can operate from short fields, forward sites, roads and surface ships providing minimum response time to targets. It has no attribute measuring capabilities.

AH-1 is a Cobra Helicopter Gunship with a primary mission of attack and close support. The AH-1 has no attribute measuring capabilities.

Maritime Special Purpose Force (MSPF) is a task-organized force formed from elements of a Marine Expeditionary Unit and naval special warfare forces that can be quickly tailored to a specific mission. The maritime special purpose force can execute on short notice a wide variety of missions in a supporting, supported or unilateral role. In the scenario software, the MSPF is capable of measuring specific attributes from a range of five miles.

Reconnaissance (RECC) teams are highly trained military units designed to conduct specialized operations such as reconnaissance, unconventional warfare and counter-terrorism actions. RECCs are capable of measuring specific attributes at a range of 4 miles in DDD.

Guided Missile Cruiser (CG) is a large combat vessel with multiple target response capability. They perform primarily in a battle force role and are multi-mission surface combatants capable of supporting carrier strike groups, amphibious forces, or of operating independently and as flagships of surface action groups.

Guided Missile Destroyer (DDG) is a fast warship that helps safeguard larger ships by operating in support of carrier strike groups, surface action groups, amphibious groups and replenishment groups. DDGs are multi-mission surface combatants which are also able to provide naval gun fire support.

Guided Missile Frigate (FFG) is an anti-submarine warfare combatant with an additional anti-air warfare capability.

Landing Platform Dock (LPD) embarks, transports and lands elements of a landing force for expeditionary warfare missions.

Landing Ship Dock (LSD), transports and launches amphibious crafts and vehicles with their crews and embarked personnel. They are mainly used to carry

Landing Craft Air Cushions (LCACs), as well Marines.

Amphibious Helo Assault Ship (LHA) is employed to land and support ground forces on enemy territory by an amphibious assault.

In the DDD software, ships may be utilized for measuring specific attributes from two miles away. Although ships have that capability, it is not recommended due to their extremely slow speeds. The primary assets for detection are UAVs, XH30s, HH60s, AV8s and AH1s.

Workload intensity of decision makers, range and location of tasks, restricted capabilities of assets and requirements of assets according to ZIPPOs

prompt decision makers to request assistance from one another. The redundancy of asset capabilities provided decision makers the ability to coordinate and support each other in successfully accomplishing task measurements and completing required actions in accordance with the ZIPPOs. Players utilized the Asset Capability for Measuring Task Attributes sheet, which displays each player's asset capabilities and limitations. Table 3 below displays tasks, attributes, assets and asset measurement ranges.

	Fishing Village			Refugee Camp		Building		Truck Convoy		Grnd Patrol	Fishing Boat		Oil Tanker	Merchant Vessel		Patrol Craft
	A1	A2	A3	A1	A2	A1	A2	A1	A2	A1	A1	A2	A1	A1	A2	A1
	Refugees	**Weapons**	**Crowd**	**Weapons**	**Crowd**	**Temperament**	**Activity**	**Cargo**	**Country**	**Country**	**Temperament**	**Cargo**	**Status**	**Cargo**	**Status**	**Country**
UAV	**15**	**15**		**15**			**15**		**15**			**12**		**12**		**12**
MSPF											**5**	**5**	**5**	**5**	**5**	**5**
RECC	**4**		**4**		**4**	**4**		**4**	**4**	**4**						
XH30	**4**	**4**		**4**			**4**		**4**	**4**	**10**		**10**		**10**	**10**
HH60	**4**		**4**		**4**	**4**		**4**	**4**	**4**	**6**		**6**		**6**	**6**
XH30	**4**	**4**		**4**			**4**		**4**	**4**	**10**		**10**		**10**	**10**
RHIB											**5**	**5**	**5**	**5**	**5**	**5**
Ships											**2**		**2**		**2**	**2**

ISR Commander
MEU
SCC

Table 3. Asset Capability for Measuring Task Attributes

Tasks may also be considered as missions. The tasks that require measurements in Experiment 11 are fishing villages, refugee camps, buildings, truck convoys, ground patrols, fishing boats, oil tankers, merchant vessels and patrol crafts. Attributes (marked "A" in Table 3) are items that must be

measured. Tasks may have different attributes and are denoted as A1, A2 or A3. The attributes measured in Experiment 11 are refugees, weapons, crowd, temperament, activity, cargo, country and status.

Assets that are capable of measuring attributes in Experiment 11 are located on the far left column of the above table. Those assets are UAVs, MSPFs, RECCs, XH30s, HH60s, RHIBs and ships (FFG, DDG, CG, LSD, LPD and LHA).

The numbers located to the right of the assets and below the attributes are the ranges in miles the assets are able to measure a specific task attribute. For example: The task Fishing Village has an attribute (A3) of Crowd that can be measured by MEUs asset RECC at a range of four miles and measured by SCCs asset HH60 at a range of four miles.

8. Roles and Responsibilities

It is important to define the roles and responsibilities of the decision makers because these roles are tied to the experimental conditions. Defining roles and responsibilities reduces the amount of confusion and misallocation of assets, allowing for more effective use of assets.

The MEU is overall responsible for land operations. This includes the following: 1) maintaining situational awareness of buildings, fishing villages, military ground patrols, refugee camps and truck convoys; 2) locate ground search and rescue and conduct rescue; 3) respond to external ISR tasking; 4) eliminate hostile CDLs and SAMs; and 5) coordinate with SCC and ISRC 6) take action according to ZIPPOs.

The SCC is overall responsible for maritime operations. This includes the following: 1) maintain situational awareness of fishing boats, merchant vessels, oil tankers and patrol crafts; 2) conduct any at sea search and rescue; 3) respond to external ISR tasking; 4) coordinate with MEU and ISRC; and 5) take action according to ZIPPOs.

The ISR Commander takes an active role in controlling high-value ISR assets (UAVs), conducts ISR taskings from higher authority, coordinates with SCC and MEU, monitors e-mail and intelligence messages and strives for efficiency in the use of ISR assets.

The ISR Coord takes an active role in de-conflicting high demand low density assets, monitoring tasks to assure periodic updates and assessments are current, coordinating with SCC and MEU, monitoring e-mail and intelligence messages and striving for efficiency in the use of ISR assets, but does not own any ISR assets.

Although the MEU, SCC, ISR Commander and ISR Coord each have an overall responsibility, the key in accomplishing tasks successfully is coordinated effort (Appendices B and C).

9. ZIPPOs

Each decision maker was given a copy of all thirteen ZIPPOs to utilize during the experiment. Due to the high op-tempo of the scenario, they were designed to provide decision makers with a quick reference guide with pictures of what action to take based on the assessment of task attributes. During the preparation and trial period of Experiment 11 by the researchers, it was concluded that providing pictures would enable faster action than providing only words. ZIPPOs are to be utilized in conjunction with the Asset Capability for Measuring Task Attributes sheet.

Because each task has its own requirements, there were thirteen ZIPPOs to support thirteen of fourteen tasks of the SCC and MEU combined. There was no ZIPPO for the ISR task. The five tasks for the SCC were as follow: 1) fishing boat 2) merchant vessel 3) oil tanker 4) patrol craft 5) at sea search and rescue (SOS). The eight tasks for the MEU were as follow: 1) building 2) coastal defense missile launcher (CDL) 3) fishing village 4) military ground patrol 5) ground search and rescue (GS&R) 6) refugee camp 7) SAM site (GSAM) 8) truck

convoy. Each ZIPPO provided the following if required: 1) measurement rates 2) reassessment rates 3) location methods 4) illumination maintenance 5) assessment rates 6) revisit rates. The ZIPPOs also provides the action to take depending on what the measurement of the task attribute was.

By providing decision makers with all ZIPPOs, not just those in their area of overall responsibility, it allowed them the opportunity to see what each decision maker's responsibilities were and where they might be able to request assistance or provide support to other players. This reduced any confusion of responsibilities, allowed for easier coordinated effort and improved the experiment data collection (Appendix H).

G. PARTICIPANTS

The participants in this experiment are multi-service members with various job specialty backgrounds, different experiences and different amount of years of service. Each participant was required to complete demographic survey, which provided background information on each participant. Participants represented Navy, Marine Corps and Army with various occupational backgrounds such as: Surface Warfare; Communications; and Field Artillery. Ranks of participants ranged from O1 thru O5. The majority of the participants were O3.

The teams were broken into seven teams of three: A, B, C, D, E, F and G. They were further broken down into the two conditions. Teams A, C, E and G are at Condition II, which is comprised of an ISR Commander, SCC and a MEU. Teams B, D and F are at Condition I, which is comprised of an ISR Coord, SCC and a MEU. Once students were assigned teams, they were able to decide amongst themselves which role they would take on. Researchers recommended that the person most adept at video games assume the responsibility of MEU.

H. TOOLS OF THE EXPERIMENT

All tools of the experiment were pilot-tested by the A2C2 research team and revised a appropriate prior to conducting Experiment 11. DDD v3 was the

primary tool in conducting the experiment. DDD provided Experiment 11 researchers with experimental control to include defining management structures, accessing information, controlling amount and types of assets, establishing task parameters and controlling the tempo of the scenario.

A large screen display was utilized to display the operational picture players see on their screen. This was helpful during the training and planning stages of the experiment.

One master binder was created to house paper documents tailored for Experiment 11. The master binder was kept on a central table that was accessible to players and researchers. The central table is also the location for players to communicate prior to commencing the experiment and during the planning phase. The master binder contained the following: Experiment 11 A2C2 Brief; Operation Ensuring Hope; DDD Legend; AOR; Asset Acronyms; Asset Capability for Measuring Task Attributes (Measuring Task Attributes); SCC Zippos (fishing boat, merchant vessel, oil tanker, patrol craft, at sea search and rescue);MEU ZIPPOs (building, coastal defense missile launcher, fishing village, military ground patrol, ground search and rescue, refugee camp, SAM site, truck convoy); Task Description; Planning Sheets (surface, ground, ISR CDR and AOR); and Monitoring Sheets. All of these materials can be found in Appendices A, C, D, E, F, G, H, I, J and K.

Five player binders were created. One for each of the three players to maintain at their own workstation and two extras to be utilized by researchers and monitors if needed. ZIPPOs are quick reference guides with pictures for players to determine what action to take based on the assessment of task attributes. The player binder contained the following: Measuring Task Attributes; SCC ZIPPOs; and MEU ZIPPOs (see Appendices G and H).

Student brief folders were given to participants at the initial brief one week prior to the experiment. The student brief folder contained the following: Experiment 11 A2C2 Brief; Legend; AOR; Asset Acronyms; Operation Ensuring

Hope; Measuring Task Attribute; Fishing Boat ZIPPO; and Task Description (see Appendices A, D, E, F, C, G, H and I). The documents in the folder assisted participants in performing the experiment more effectively.

The Experiment 11 A2C2 Brief was provided to give participants an understanding of what the experiment was about to include the geopolitical situation, status of countries involved, area of responsibility, different management structures, responsibilities of each decision maker, organization of forces (assets and their locations), utilization of the Asset Capability for Measuring Task Attributes sheet and utilization of ZIPPOs. Operation Ensuring Hope provided a more in depth explanation of the geopolitical situation. The DDD Legend provided an icon associated with each task as it appeared on the video screen. AOR was provided and defined to ensure participants understood their focus area to eliminate their use of assets in non-required areas. The Asset Acronyms document provided the multi-service participants with what the acronyms stood for and a brief description of the capabilities of each asset. The Measuring Task Attribute sheet displays each decision maker's asset ownership, capabilities and limitations. ZIPPOs provided decision makers with a quick step by step reference guide on what action to take depending on attribute measurements. The Task Description document provided a written detailed description of each ZIPPO. The Planning Sheets were provided to utilize during the planning stage. Each team was provided a planning sheet to be completed by each decision maker (ground, sea and ISR). A blue pen was utilized for sea, green for ground and purple for ISR for planning purposes. A red pen was used by the team to conduct re-planning to be able to differentiate form the initial plan. Monitoring Sheets were utilized by monitors to collect task measurement times to determine if decision makers were conducting measurements within the prescribed times. This was captured after 15 minutes, 30 minutes and 45 minutes of play. The DDD Training Pointer sheet provided researchers with a standard guideline to conduct training on buttonology.

I. EXPERIMENTATION AND DATA COLLECTION

By collecting tape recordings, simulation recordings, log history files and paper assessments during the experiment, researchers are able to conduct future data analysis. Paper assessments utilized can be seen in the appendices, chapter VI.

1. Tape Recordings

The NPS research team utilized 90 minute tapes and recorded approximately three and a half hours of data per team. Back-up recording was conducted on a portable recorder by professors from the University of San Diego, who were gathering eye tracking data. Recordings were conducted to capture the communication and coordination amongst team members to get insight into each team's performance. Coding was conducted real-time on all experiments prior to Experiment 11. Due to the limited number of researchers, it was not feasible to conduct real-time coding. However, the data collected from Experiment 11 will be utilized for future coding.

2. Simulation Recordings

Simulation recordings come from utilizing the DDD. They are recordings of the actions that each player takes during the scenario. Simulation recordings can be utilized for review, playback and/or analysis. By reviewing the recordings researchers are able to determine items such as latency, accomplishment of tasks and average time between measurements.

3. Log History Files

Log history files provide the actions of each decision maker. It provides the time a measurement was made, what asset is utilized and the task number. These file may be utilized for review and future analysis. Data from the log history files were reviewed for relevance and converted into an excel spreadsheet to allow for ease of data analysis . Data were then organized to

represent each team (A thru G) and each group (ISR Commander/Coord) for each of the test data categories. An ANOVA was then computed for each group to determine the differences in variances between the two ISR Officer roles.

4. Demographic Survey

The Demographic Survey is a collection of the participants experience background.

5. Workload (TLX) Questionnaire

The NASA Task Load Index is a multi-dimensional rating procedure that provides an overall workload score based on a weighted average of ratings on six subscales: Mental Demands; Physical Demands; Temporal Demands; Own Performance; Effort; and Frustration. The subscales are defined in Figure 1 below.

RATING SCALE DEFINITIONS		
Title	**Endpoints**	**Descriptions**
MENTAL DEMAND	*Low/High*	How much mental and perceptual activity was required (e.g., thinking, deciding, calculating, remembering, looking, searching, etc.)? Was the task easy or demanding, simple or complex, exacting or forgiving?
PHYSICAL DEMAND	*Low/High*	How much physical activity was required (e.g., pushing, pulling, turning, controlling, activating, etc.)? Was the task easy or demanding, slow or brisk, slack or strenuous, restful or laborious?
TEMPORAL DEMAND	*Low/High*	How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred? Was the pace slow and leisurely or rapid and frantic?
EFFORT	*Low/High*	How hard did you have to work (mentally and physically) to accomplish your level of performance?
PERFORMANCE	*Good/Poor*	How successful do you think you were in accomplishing the goals of the task set by the experimenter (or yourself)? How satisfied were you with your performance in accomplishing these goals?
FRUSTRATION LEVEL	*Low/High*	How insecure, discouraged, irritated, stressed and annoyed versus secure, gratified, content, relaxed and complacent did you feel during the task?

Figure 1. Workload (TLX) Questionnaire Subscales

6. Teamwork Assessment: Observer Rating Form

The Teamwork Assessment allowed researchers to rate team performances in five areas. This enabled the two management structures to be compared to determine which structure works more efficiently. The five areas of performance are:

1) Communication Behavior. Involves the proper exchange of information between two or more team members.

2) Monitoring Behavior. Observation of team member's performance.

3) Back-up Behavior. Involves how team members assist each other.

4) Coordination Behavior. Involves how well team members work with each other to accomplish mission.

5) Team Orientation. Refers to how in sync team members are in mission goals.

7. A2C2 ESG Post-Experiment Survey

The post-experiment survey is a self assessment. This assists in improving the planning process and enables the research group to see how the participants evaluate their performance in both planning and implementation. Utilizing this survey also bridges the planning process for future planning processes such as the MHQ/MOC.

8. Survey Analysis

Analysis of Workload (TLX) Questionnaires, Teamwork Surveys and Post-Experiment Surveys were analyzed to determine if there was any correlation between how the teams worked together and the latencies for emergent tasks. Analysis information of the data can be seen in Chapter IV.

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IV. EXPERIMENT RESULTS

A. OVERVIEW

Experiment 11 of the A2C2 program provided an abundance of data for analysis. Due to the large volume of data produced, only the most critical portion of this data was analyzed in this thesis. The primary data analyzed here are the time (latencies) for each team in detecting, measuring and revisiting tasks assigned to them. The team data were then organized into two groups, C1 (ISR Coordinator) and C2 (ISR Commander), each representing a different level of the independent variable. An analysis was conducted with the group data in order to establish which level of the independent variable proved more efficient in the planned ISR mission tasks. Another analysis was conducted on the two levels of the independent variable using the data for the “emergent” tasks. These tasks popped-up or “emerged” via e-mail and were included as a way of measuring the teams’ reactions to unanticipated conditions.

Data were also collected using written artifacts collected during Experiment 11. Workload Task Load Index (TLX) questionnaires, Teamwork Surveys, and Post Experiment Assessment forms were filled out by the participants and the observers in order to gain a better understanding of how these teams worked together. Finally, a preliminary look was taken using the planning sheets from each team to determine any correlation between teams that adapted their plans and the efficiency of those teams according to latencies for measuring and revisiting tasks.

B. MODEL VERIFICATION

After many dry runs of the Experiment 10 scenario with A2C2 investigators, changes were made to the Experiment 11 scenario. These changes included the removal of assets in order to make the differences between the two command structures more distinguishable. The play time was also

modified from past experiments in order to add a certain amount of time pressure to the teams. The most pronounced modification in this experiment was the incorporation of operational planning designed to give participants more of a real world feel and mimic the MHQ/MOC planning cell.

C. EXPECTED RESULTS

Experiment 11 was intended to demonstrate measurable differences in the efficiencies of the two command structures under study. The intuitive motivation for this work was that one structure would induce more communication, collaboration, and cooperation than the other. The two levels of the independent variable were intended to highlight these differences; ISR Coordinator (C1), and ISR Commander (C2).

The ISR Coordinator group was designed to mimic a unit whose high value ISR assets are coordinated with the assistance of an ISR Coordinator. This coordinator does not own any assets and her input is considered wise guidance rather than hard orders. If a situation arises where the ISR coordinator receives a task that she considers a higher priority than what is being accomplished at the time, the coordinator can communicate this concern to the participants and they may respond immediately, or complete their ongoing tasks and move on to the new task, or completely ignore the Coordinator's suggestion and continue with their plan. Emergent tasks in the scenario were used to observe these choices among the experimental team.

The ISR Commander structure was designed to mimic a unit whose ISR assets are controlled by an ISR Commander. The commander owns the Unmanned Aerial Vehicle (UAV) assets and has the authority to use them as she sees fit. It was expected that this command structure would induce a more directive style of planning and utilization of assets. The emergent tasks were also used here to observe this behavior in the experimental teams.

D. ACTUAL RESULTS

We focus our analysis on the latencies between arrival and detection, detection and first measurement, and first measurement and subsequent measurements of tasks assigned both by team and by group. The Workload questionnaires, Teamwork surveys, and Post Experiment surveys were also analyzed to observe any correlation between perceived team efficiencies and the latencies for emergent tasks. Finally, we will examine the team planning documents for correlations between the number of changes made to plans and ultimate performance as measured by task latencies.

Using the log history files of the DDD, the data were scrubbed for those data of interest to this study, and then converted into Excel spreadsheet format in order to better manipulate and analyze the data. The data were then organized into mean times for each team for each of the test data categories then reorganized into two groups each representing one of the command structures. To examine the between and within group variances, an ANOVA was computed for the group data. Group C1 represented the ISR Coordinator structure (teams B, D, and F). Group C2 represented the ISR Commander structure (teams A, C, E, and G). It would be reasonable to conclude that if the differences in variances between the groups were greater than the difference in variance between the teams, the imposed structure (Commander versus Coordinator) induced or inhibited certain efficiencies in team performance.

A single factor ANOVA for the latency in arrival and detection of tasks indicated a significant difference between C1 and C2, with a p value of 0.12. The value in the average category is the actual mean latency in seconds for 43 tasks (see Figure 2). The lower mean for C2 suggests lower (more efficient) latency in the ISR Commander structure for this analysis.

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
C1 (ISR Coord)	3	835.853	278.6177	231.3906
C2 (ISR Cdr)	4	1008.507	252.1268	407.0075

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1203.032	1	1203.032	3.572364	0.11735	6.607891
Within Groups	1683.804	5	336.7608			
Total	2886.836	6				

Figure 2. Single Factor ANOVA for the Latency in Arrival and Detection of Tasks

More detailed ANOVAs were computed for latencies between detection and first measurement, first measurement and tasks requiring subsequent measurements every 20 min, and first measurement and tasks requiring subsequent measurements every 15 minutes. These more granular analyses showed less significant differences between the two structures.

The measurements taken of latencies between detection, first measurement and subsequent measurements by the teams are compiled into group data and arranged in Figure 2. Of significance in these analyses, the 15 minute subsequent measurement tasks showed that the Coordinator (C1) structure had a lower latency than Commander (C2) structure.

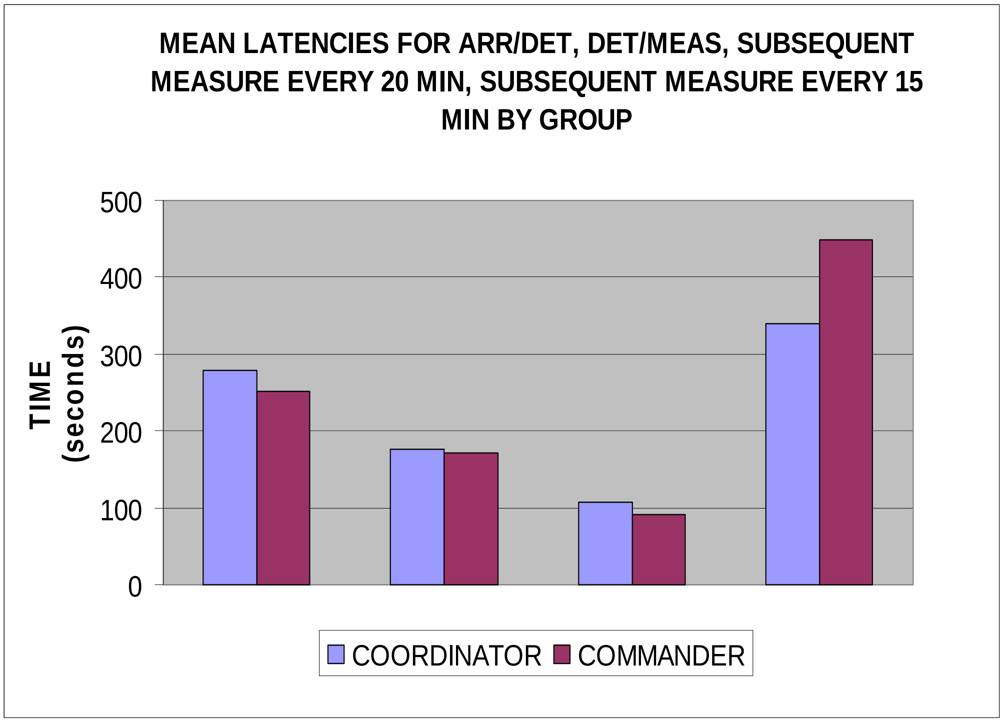

Figure 3. Mean Latency Data

The latency data for the emergent tasks showed less significant differences (p=0.33) between C1 and C2 than the overall arrival and detection of tasks, though given the premise of the experiment these are still interesting results bearing further study. In particular, it is interesting to note that the mean latencies for each structure showed a large difference for Task 242 where the ISR Commander completed the task in a shorter amount of time, and in Task 346 where the ISR Commander completed the task in a longer amount of time. These differences are attributed to individual team performance and not to any factor dealing with the independent variable. The mean latencies are seen in Table 4.

Mean latencies For Emergent Tasks By Team and Structure			
Task #	**ISR Coordinator**	**ISR Commander**	**ANOVA significance**
242	207	9	n.s.
244	47	12.25	n.s.
250	28.33	80	n.s.
346	26.33	487.75	n.s.
Note: Latency in seconds			n.s.

Table 4. Mean Latencies for Emergent Tasks

E. PARTICIPANT OBSERVATION DATA

The written documentation analyzed here consisted of Workload Task Load Index (TLX) questionnaires, Teamwork surveys, and Post Experiment surveys that were filled out by the participants. The participants were asked to judge their experience during the experiment in certain categories. The Workload questionnaire consisted of Mental Demand, Physical Demand, Temporal Demand, Performance, Effort, and Frustration categories that the participants were asked to judge on a scale from 0 to 10 with 0 being low and 10 being high. These data were collected, organized into team and group categories, means were computed for each team, for each group (Coordinator and Commander), and for each of the test categories. ANOVAs were computed to compare the two structures in each of the test categories and with all the categories as a whole. Although the ANOVA findings were non-significant, the means were interesting to observe as most ratings were close together with the biggest difference being in the Physical Demand category as seen in Table 5.

Workload Ratings Comparing the Two Structures	ISR Coordinator	ISR Commander	ANOVA significance
MENTAL DEMAND	6.92	7.02	n.s.
PHYSICAL DEMAND	1.97	2.81	n.s.
TEMPORAL DEMAND	6.53	5.94	n.s.
PERFORMANCE	7.31	7.46	n.s.
EFFORT	6.86	6.52	n.s.
FRUSTRATION	4.53	4.77	n.s.
Note: Means based on a rating scale 0=Low and 10=High			

Table 5. Two Structure Workload Ratings

The Teamwork surveys consisted of Communication Behavior, Monitoring Behavior, Back-up Behavior, Coordination Behavior, and Team Orientation categories. The participants were asked to judge their teams on a scale of 1 to 7 with 1 being poor and 7 being good. The Teamwork survey data were also gathered and organized in the same fashion as the Workload questionnaires and the same computations were conducted on these data. The ANOVA did not render any significant findings, but interestingly there were no great differences in the means in Table 6.

Teamwork Ratings Comparing the Two Structures			
	ISR Coordinator	**ISR Commander**	**ANOVA significance**
Communication Behavior	5.67	5.67	n.s.
Monitoring Behavior	6	5.67	n.s.
Back-up Behavior	5.44	5.33	n.s.
Coordination Behavior	5.57	5.67	n.s.
Team Orientation	5.89	5.83	n.s.
Note: Ratings based on a scale of 1=Low and 7=Excellent			

Table 6. Teamwork Ratings

The Post Experiment surveys consisted of several questions designed to measure the extent of how effective the participants considered their plans to be.

The participants were asked to answer these questions on a scale of 1 to 7, 1 being not at all and 7 extremely effective. This data was also organized and analyzed in the same manner as the other two written documents. The ANOVAs also rendered non significance and the questions and means are in Table 7.

Post Experiment Ratings of the Two Structures			
	ISR Coordinator	**ISR Commander**	**ANOVA significance**
How effective was your team's original plan?	5.33	5.5	n.s.
How effective was your team's planning process?	5.56	5.92	n.s.
How effective were you in being able to re-plan?	6	5.92	n.s.
How effective were you in being able to implement the plan you developed?	5.22	5.58	n.s.
What is your overall assessment of your team's performance?	5.56	5.92	n.s.
How well did the team as a whole act in support of others?	5.78	5.92	n.s.
Note: Ratings based on a scale 1=not at all 7=extremely effective			n.s.

Table 7. Post Experiment Ratings

The preliminary look at the planning sheets showed that team A did not make any changes to their plan, team B made 14 changes, team C made 8 changes, team D made 9 changes, team E made 10 changes, team F made 8 changes, and team G made 11 changes. These data were organized into team categories, then group category, means were computed and an ANOVA was computed for the two command structures. The results were an F value of 0.85, a p value of 0.397, and an F crit. of 6.607. This suggests only weak differences between the Coordinator and Commander structures. There seems to be no correlation between the amount of re-planning and quality of performance.

F. CONCLUSIONS

The results from Experiment 11 suggest weak differences between the two imposed command structures. Further detailed analyses of these data are needed in order to draw more concrete conclusions as to the relationship between operational planning and team efficiency. These results may be attributed to any number of factors. When conducting human-in-the-loop experiments controls are often difficult to enforce. Teams were established with the intent to randomize groups with respect to experience and years of military service, but these are difficult variables to measure. Any experience the participants had in working as team (in other class work) may have dampened emergent behaviors due to the command structures. The players in the ISR Commander role might not have had enough experience in command in order to assert as directive an approach as was expected. Another factor could be that the participants had pre-conceived notions as to the expected outcome of the experiment and these notions could have guided their actions. An example of this is players focusing on completing their own tasks prior to providing assistance to other players.

There also exist many different methods in which to analyze the data. In <u>Two Types of ISR Commands under Two Different Mission Intensities: Examining ESG Concepts</u> (Entin et al., 2008) data from A2C2 Experiment 10 were examined with a slightly different methodology. Specifically, three structures and two different mission intensities were studied with respect to task accuracy. Experiment 10 scenarios contained more ISR assets to accomplish the tasks required and the time of play was slightly different than Experiment 11. Their analysis of Experiment 10 data clearly shows a marked advantage for the ISR Commander structure during times of low intensity with respect to task accuracy (Entin et al., 2008). Those results, coupled with this thesis, suggest further experimentation is warranted.

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V. CONCLUSIONS

A. SUMMARY

The Adaptive Architecture for Command and Control (A2C2) Experiment 11 investigated the team efficiencies completing intelligence, surveillance, and reconnaissance (ISR) tasks under two different command and control structures. The ISR Coordinator (C1) structure employs a team member (coordinator) who takes an active role in de-conflicting high demand low density assets, monitoring tasks to assure periodic updates and assessments are current, coordinating with SCC and MEU, monitoring e-mail and intelligence messages and striving for efficiency in the use of ISR assets, but does not own any ISR assets. In the ISR Commander (C2) structure, a team member (commander) takes an active role in controlling high-value ISR assets (UAVs), conducts ISR taskings from higher authority, coordinates with SCC and MEU, monitors e-mail and intelligence messages and strives for efficiency in the use of ISR assets. Overall, the experiment employed 21 participants and four monitors. Participants were divided into seven teams of three each, spread across two different (C1, C2) groups.

Experiment 11 also introduced a new variable into the game play, that of operational planning before and during the exercise. Participants were given briefs as to their missions and asset capabilities, and then were given the opportunity to plan a strategy to efficiently employ these assets. After 20 minutes of DDD game play, the exercise was paused. At this break, the participants received feedback on their effectiveness from monitors who had recorded whether required ISR assessments had occurred and at what latency. They were then given the time to re-plan their strategy. Play then continued for another 25 minutes. The intent of this planning process was to mimic operational level planning such as that done under the MHQ with MOC concept.

B. RECOMMENDATIONS FOR FUTURE EXPERIMENTS

Largely weak differences were observed between the two command structures studied, though in general the C2 (ISR Commander) group seemed to demonstrate better task performance (lower latency). Task load worksheets and other participant artifacts seemed to indicate little difference between the command structures.

The homogeneity of written responses, though, does suggest that future experiments could more radically alter task loading and command structure to make the experimental differences more apparent to players. Another interpretation would be that this is not a situation of weak experimental power, but instead of a finding that having an ISR Coord adds significant value to the efficient use of ISR assets, to the point of "equal" performance with an ISR Commander who controls the high value ISR assets (UAVs).

Further, the players often seemed to focus on the operation of the DDD rather than the big picture scenario. Future experiments could use personnel who are accustomed to operating computers as non-participants or confederates to the experiment to operate DDD for the participants.

Another recommendation would be to employ personnel with some operational experience for participants (0-3 and 0-4), and only use personnel with some command experience as the commanders and coordinators (0-5 and 0-6). Failing that, the positions of ISR Commander and Coordinator could be scripted as to what decisions to make at what times. In this manner the factors of the independent variable may be drawn out and made more distinguishable. The planning process should certainly continue to be incorporated in future experiments.

C. CONCLUSIONS

The DDD simulator has proved to be of great benefit in all of the A2C2 experiments conducted in the past, and provided a wealth of data for analysis in

Experiment 11. Though the analyses of the written participant artifacts indicated little differences between the two command structures (C1, C2), the DDD data suggests more efficiency (shorter latency) for the ISR Coordinator (C1) in the category of 15 minute tasks. This in turn suggests that future experiments may be manipulated in such a way as to make the differences between the two command structures more distinguishable. By using the same written artifacts, experimenting with different scenario modifications, and continuing to incorporate operational planning, the A2C2 project may be able point the way towards the more efficient ISR command structure.

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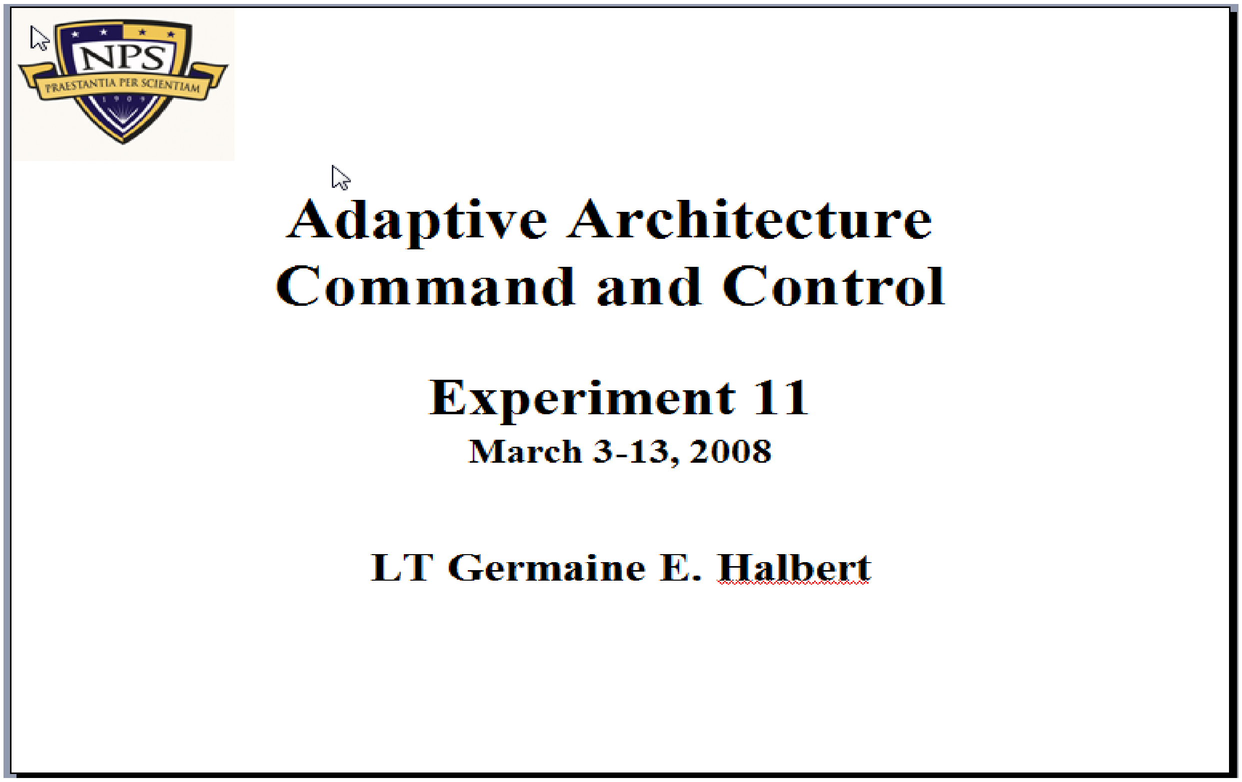
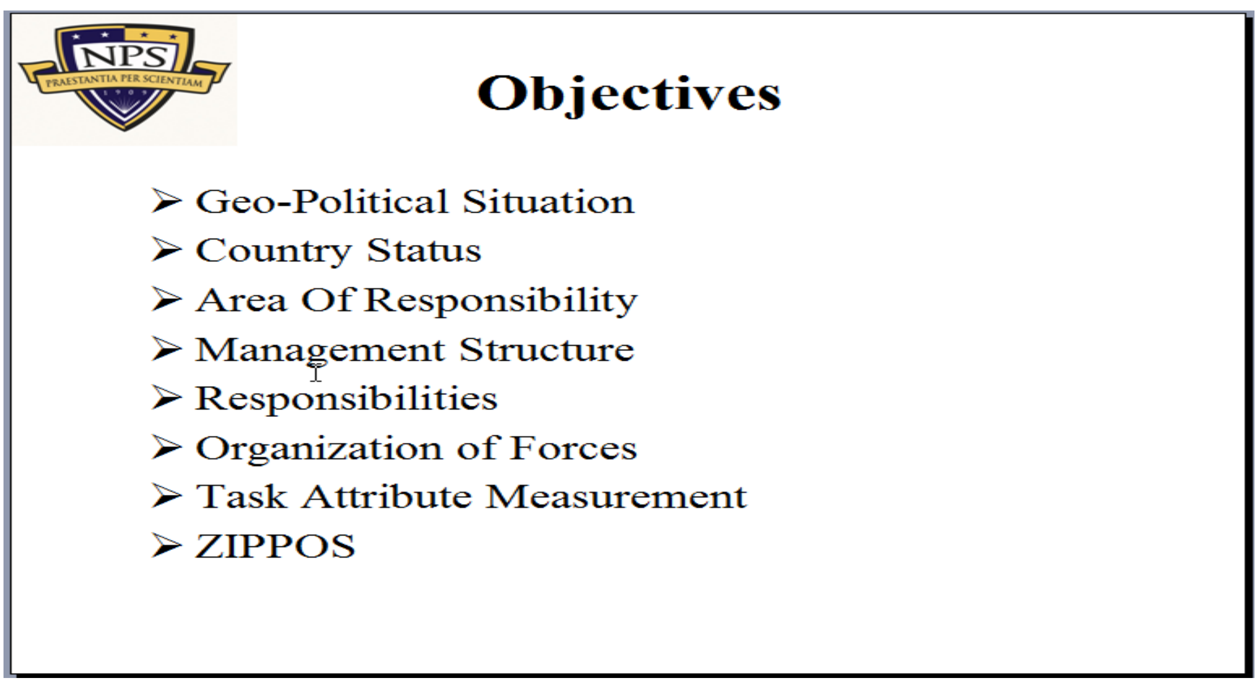
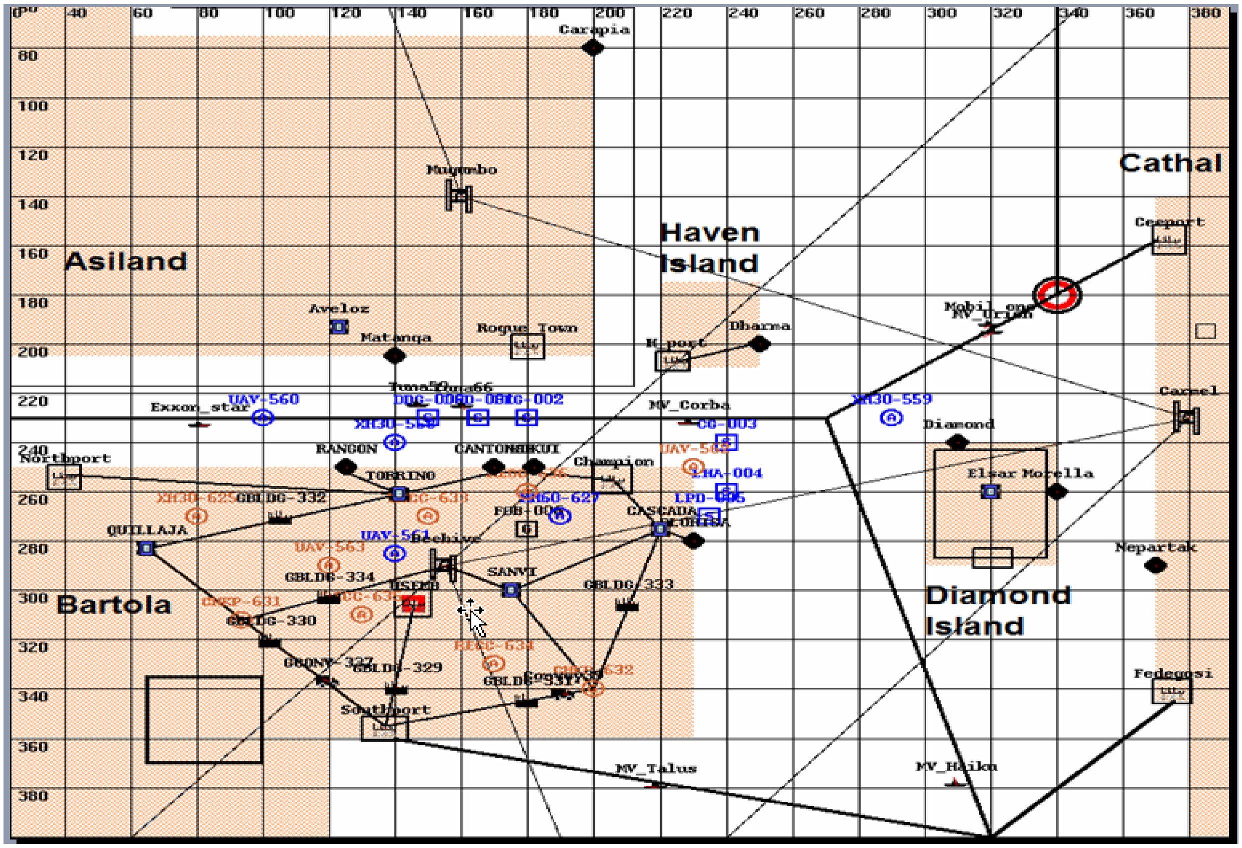
APPENDIX A EXPERIMENT 11 A2C2 BRIEF







Geo-Political Situation (1)

- 30 days ago the country of Asiland was struck by a tsunami that caused massive damage to the country's infrastructure.
- United States was invited by the Bartola government to provide humanitarian and disaster relief assistance to Bartola and the organizations operating within it. ESG-7 was dispatched to the region to assume these tasks.
- A day after the arrival of ESG-7, Bartola officials reported a large insurgent uprising in the southwest area of Bartola. Insurgents, now supported by groups from Asiland have begun to wrest control of the area from Bartola's forces.

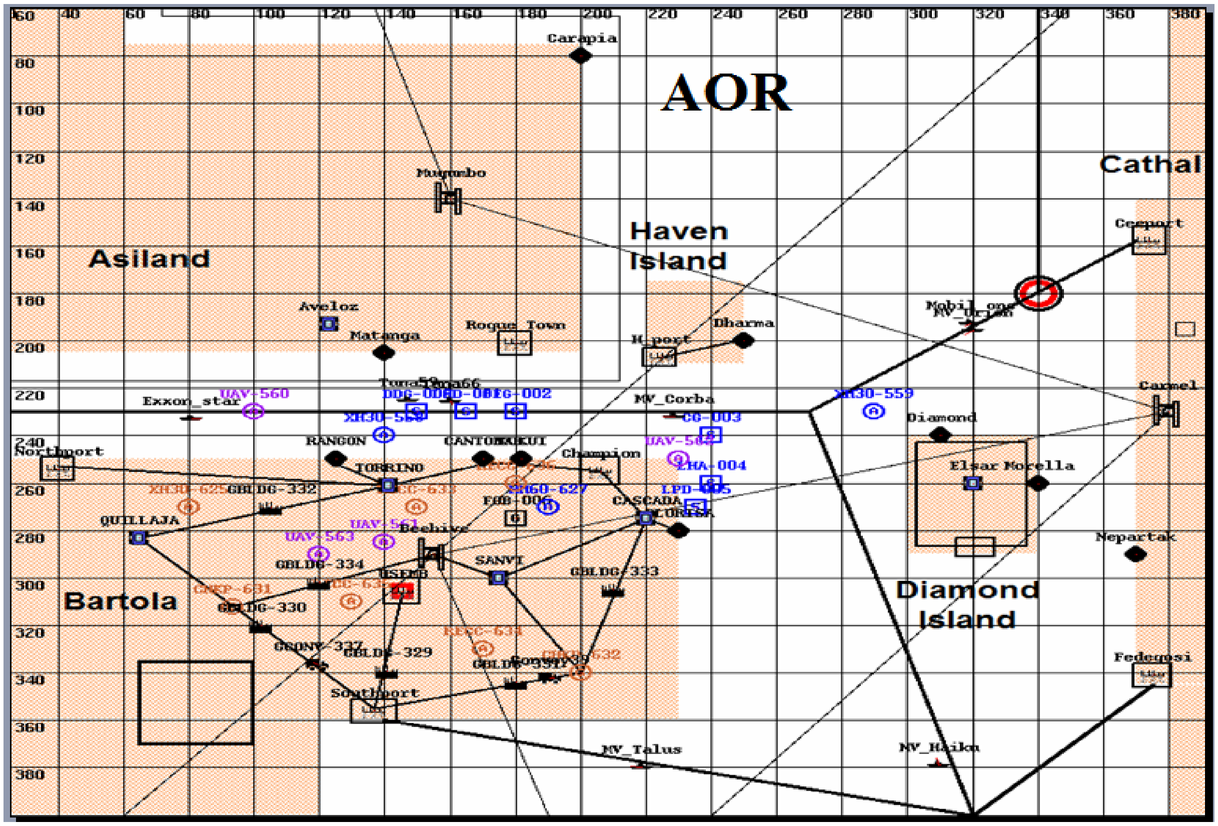
Geo-Political Situation (2)

- The government of Bartola has requested United States forces to help counter the insurgency. The United States has agreed, and has deployed the majority of 31st MEU forces out of tsunami AOR.
- Bartola's military patrols within the tsunami relief AOR have become overwhelmed. United States forces are required to assist in ISR missions and sea/ground efforts.
- Coastal defense missile launchers once located on Asiland are missing.
- Waters in the AOR are inherently unsafe due to piracy and smuggling operations including hostile operations against white shipping.

"OPERATION ENSURING HOPE"

Country Status

Bartola	Asiland
➢Professional Army, Navy and Air Force ➢Internal ethnic rivalries have led to insurgency ➢Insurgent attacks on government land facilities, food convoys and merchant shipping ➢Numerous refugee camps have been established ➢International agencies have set up refugee operations in northern fishing villages	➢Government majority corrupt ➢Government military is small and ineffectual ➢Navy consists only of small patrol crafts that stay relatively close to shore ➢Army is corrupt ➢At least one terrorist group within Asiland has collaborated with Bartola's insurgency



Management Structure

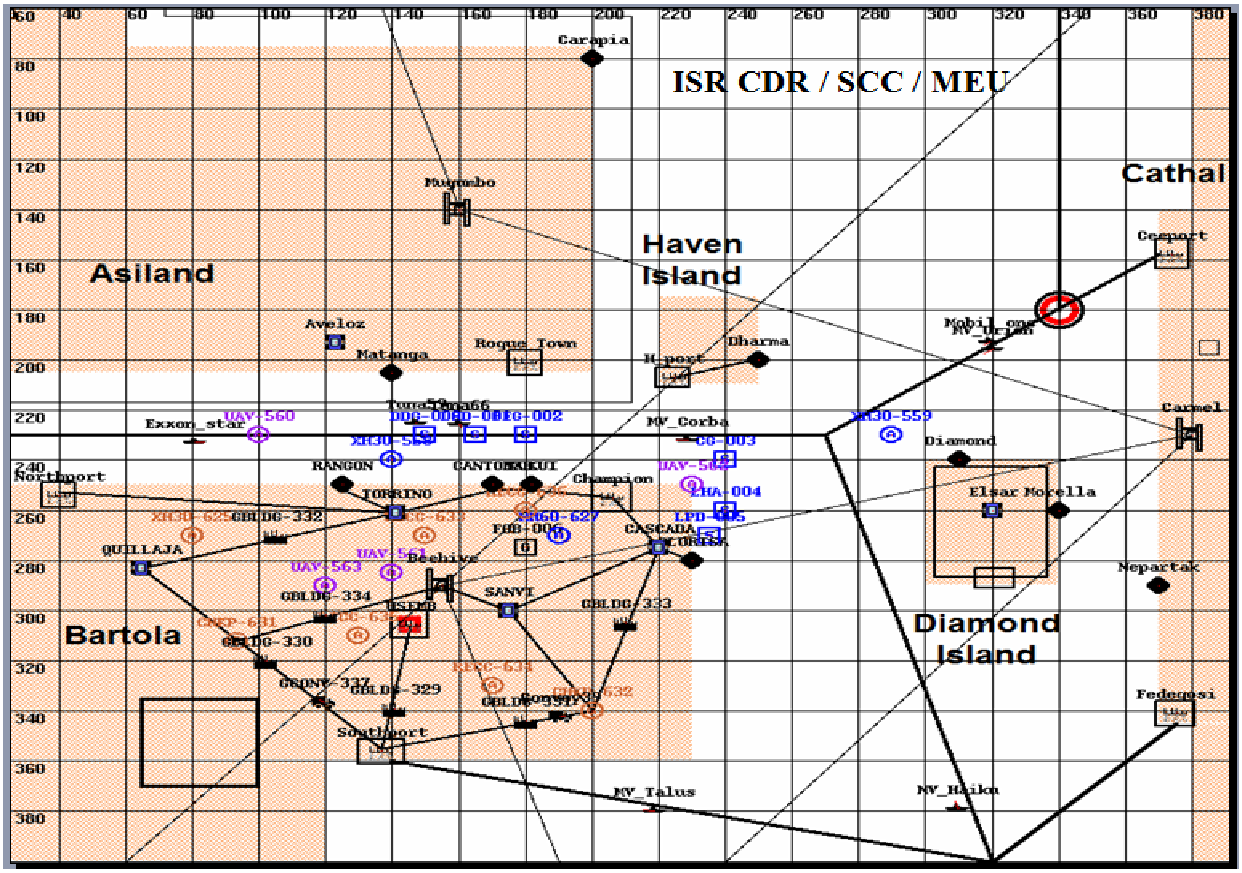
HALF	**HALF**
➢ **ISR Commander**	➢ **ISR Coordinator**
➢ **SCC**	➢ **SCC**
➢ **MEU**	➢ **MEU**

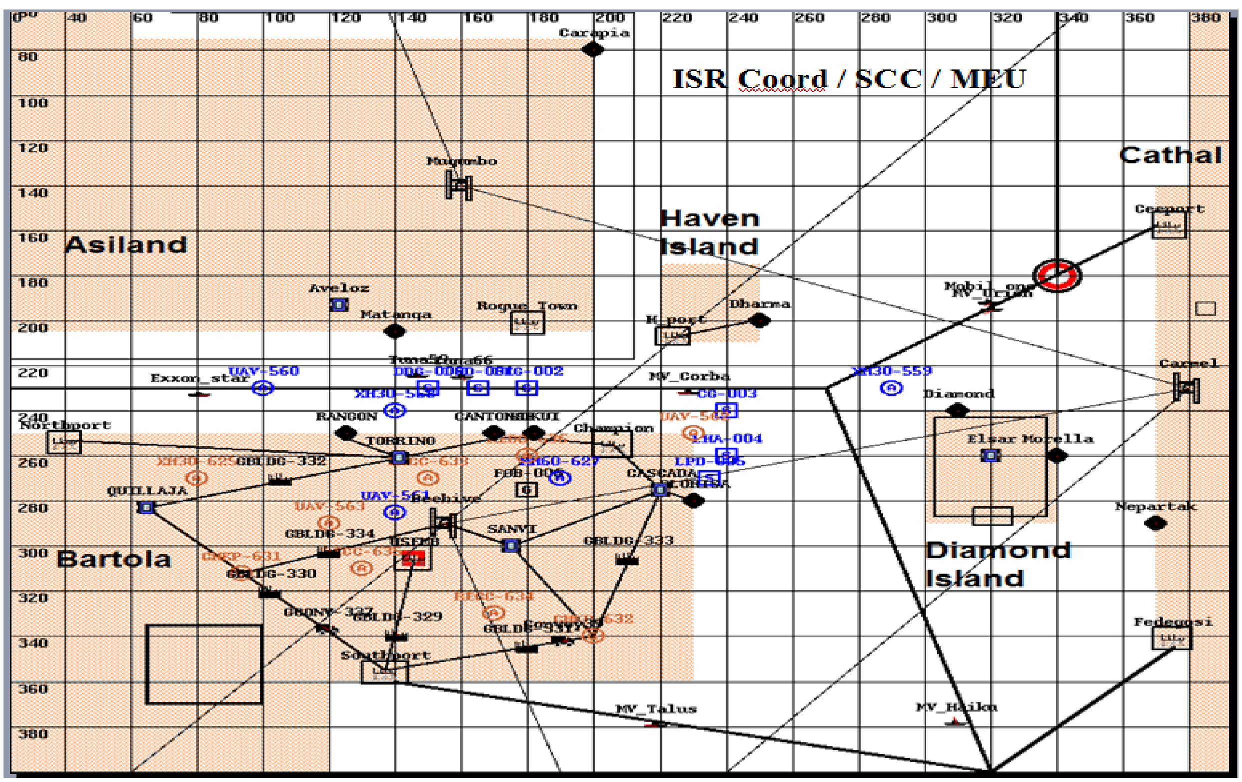
Responsibilities (1)

SCC	MEU
➢ Maintain situational awareness -Fishing boats -Merchant vessels -Oil tankers -Patrol crafts ➢ Conduct any at sea search and rescue ➢ Respond to external ISR tasking ➢ Coordinate with MEU and ISRC ➢ Take action according to ZIPPOs	➢ Maintain situational awareness -Buildings -Fishing villages -Military ground patrols -Refugee camps -Truck convoys ➢ Locate ground search and rescue and conduct rescue ➢ Respond to external ISR tasking ➢ Eliminate hostile CDLs, SAMs ➢ Coordinate with SCC and ISRC ➢ Take action according to ZIPPOs

Responsibilities (2)

ISR Commander	ISR Coordinator
➢ **Control high-value ISR assets** (UAVs). ➢ **ISR Taskings from Higher Authority:** Conduct as necessary. ➢ **Coordinate with SCC and MEU**: Synchronize asset utilization. Work together on task selection and resource allocation. ➢ Monitor e-mail and intel messages, including ISR tasking from higher authority. ➢ Strive for efficiency in the use of ISR assets.	➢ De-conflict asset scarcity problems. ➢ Monitor tasks to assure periodic updates and assessments are current. ➢ **Coordinate with SCC and MEU**: Synchronize asset utilization. Work together on task selection and resource allocation. ➢ Monitor e-mail and intel messages, including ISR tasking from higher authority. ➢ Strive for efficiency in the use of ISR assets.


ISR CDR / SCC / MEU
Asiland
Haven Island
Cathal
Bartola
Diamond Island


ISR Coord / SCC / MEU
Asiland
Haven Island
Cathal
Bartola
Diamond Island

Organization of Forces

ISR CDR	SCC	MEU
➢ UAVs (4)	➢DDG: RHIB (1)	➢LHA: AV8 (1)
These are either "owned" by an ISR Commander or are distributed equally between the SCC and MEU -- depending on the particular ISR management structure.	➢CG: RHIB (1)	➢LHA: AH1 (1)
	➢FFG: XH30 (2)	➢LHA: XH30 (2)
	➢LPD: LCU (1)	➢LSD: MSPF (1)
	➢LSD: LCAC (2)	➢LPD: MSPF (1)
	➢LHA: HH60 (2)	➢Bartola: RECC (4)

Task Attribute Measurement

	Fishing Village			Refugee Camp		Building		Truck Convoy		Grnd Patrol	Fishing Boat		Oil Tanker	Merchant Vessel		Patrol Craft
	A1	A2	A3	A1	A2	A1	A2	A1	A2	A1	A1	A2	A1	A1	A2	A1
	Refugees	Weapons	Crowd	Weapons	Crowd	Temperament	Activity	Cargo	Country	Country	Temperament	Cargo	Status	Cargo	Status	Country
UAV	15	15		15			15		15			12		12		12
MSPF											5	5	5	5	5	5
RECC	4		4		4	4		4	4	4						
XH30	4	4		4			4		4	4	10		10		10	10
HH60	4		4		4	4		4	4	4	6		6		6	6
XH30	4	4		4			4		4	4	10		10		10	10
RHIB											5	5	5	5	5	5
Ships											2		2		2	2

Notes: Numbers in the cells above denote attribute measurement ranges

Primary assets for detection are UAVs, XH30s, HH60s, AV8s and AH1s

AV8s, AH1s, LCACs and LCU have no measuring capabilities

MEU
LHA: AV8 (1)
LHA: AH1 (1)
LHA: XH30 (2)
LSD: MSPF (1)
LPD: MSPF (1)
Bartola: RECC (4)

SCC
DDG: RHIB (1)
CG : RHIB (1)
FFG: XH30 (2)
LPD: LCU (1)
LSD: LCAC (2)
LHA: HH60 (2)

ZIPPOs

- Each task has own requirements
  - Detection, measurement of attributes, prosecuting
  - Revisit times
- Task management
- Guidance on what action to take
- Required asset(s) for prosecution

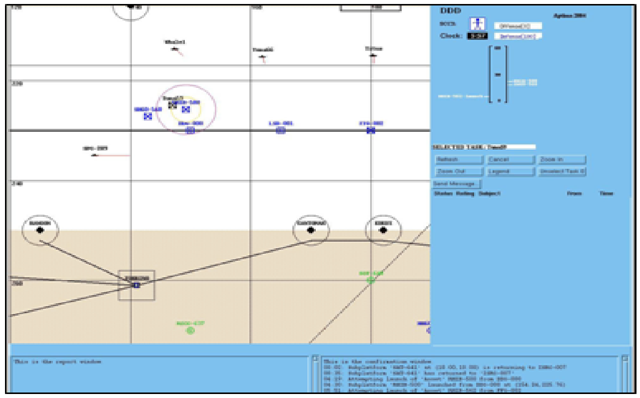
i.e.: Fishing Boat

- Task description

Questions?

APPENDIX B DDD SIMULATION BRIEF

Dynamic Distributed Decisionmaking (DDD) Simulation: Overview



Naval Postgraduate School
A2C2 Expt 11: March 2008

The Expeditionary Strike Group (ESG)

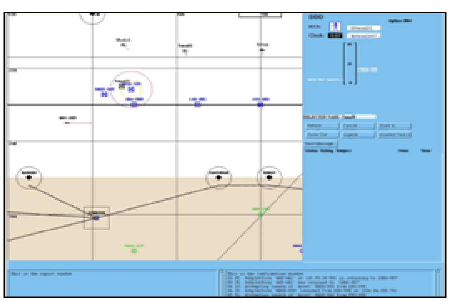
- Personnel:
  - ESG FO/GO with a staff of ~50
  - Amphibious Squadron (PHIBRON) Commodore and staff of ~35; dual-hatted as Sea Combat Commander
  - Marine Expeditionary Unit (Special ... Commander and ...
  - ...
- Missions:
  - Expeditionary Warfare, MIO, MSO, SUW, USW, MIW, STRIKE, Air Defense, HA/DR …
- Major Platforms:
  - Amphibious Assault Ship (LHA), Dock Landing Ship (LSD), Amphibious Transport Dock (LPD), Cruiser (CG), Destroyer (DDG), Frigate (FFG), [Fast Attack Sub (SSN)]

Research Issue: Managing ISR

Experiment Basics

- This is an ISR focused experiment
  - Uses a limited subset of ESG assets/capabilities
  - Requires prioritization of scarce (ISR) assets
    - You will need to plan actions and coordinate/communicate
- Your assets will be assigned from the start
  - You, as a player, own and control color-coded *air assets, UAVs, ground assets, sea assets*
- Things to do: Gather data, investigate unknowns, protect friendlies, eliminate enemy/insurgent threats
- Half of the teams will have an ISR *coordinator*, the other half will have an ISR *commander*
- Purpose of this briefing
  - Introduction to the DDD
  - Overview of the simulation's User Interface

Distributed Dynamic Decisionmaking (DDD) Team-in-the-Loop Simulation Environment

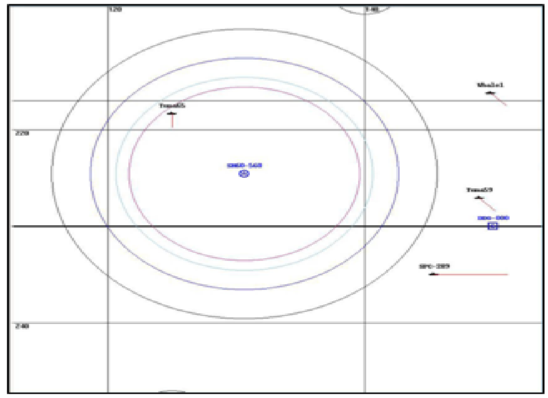


DDD-I: 1984-89
DDD-II: 1989-94
DDD-III: 1994-08
DDD-IV: 2008+

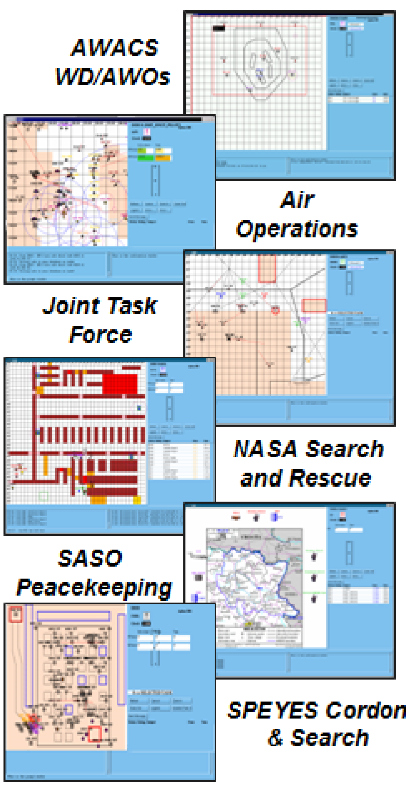
- Developed jointly by UConn, NPS, Aptima, Inc. over 20 yrs
- Funded largely by the Office of Naval Research A2C2 program
- DDD captures the functional relationship of team dynamics
  - High fidelity is not required or necessary
- Employed in over 35 experiments involving NPS & other Navy/DoD organizations
- Goal is valid experimentation on C2, not duplication of operational conditions

DDD Fundamentals

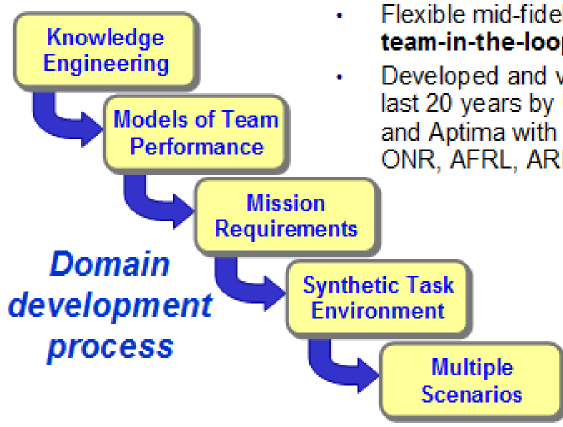
- DDD is an empirical research tool for lab-based C2 studies
- Independent variables
  - Team structure
  - Access to information
  - Control of resources
  - Mission parameters
- Provides substantial degree of experimental control
- Ease of user play (WIMP)
- Designed to collect many dependent measures
  - Time, accuracy, …
- Underlying paradigm is designed for model-driven experimentation



Distributed Dynamic Decisionmaking (DDD)



- Flexible mid-fidelity distributed **team-in-the-loop simulator**
- Developed and validated over last 20 years by UConn, NPS and Aptima with support from ONR, AFRL, ARI, NASA, NSF



- Automated team-in-the-loop simulation to train:
  - Critical Teamwork Skills
  - Information and Resource Management
- Control-realism balance
- Capture the essential elements of many different team C2 tasks
- Effective testbed for conducting experiments in a number of different tactical environments
  - Database of more than 80 experiments across several sites
- Measures are collected to assess Team Performance, Decision Strategies, Team Coordination and Communication
- Multiple uses
  - Performance research; Team training; Technology insertion effects; Algorithm evaluation; Agent-human calibration
- Multiple environments:
  - AWACS, Joint Task Force, Search and Rescue, MC2A, SASO, …

DDD Basics: **Tasks**

- An item/object that requires (the use of assets for its) processing ~ something we "do things on"
  - e.g., S&R, fishing boat, refugee camp, SAM site …
- Typical activities on a task:
  - Localization and detection, tracking
  - ***Measurement of relevant attributes***
  - Decisions on if, how, and when to attack
- ***Attributes***: cargo, temperament, crowd, country of origin, weapons present, …
  - Attributes can and do change with time and events
  - Attribute values will determine if and how a task is to be "attacked" or processed

DDD Basics: **Assets**

- "Controllable" and/or "movable" **units**, e.g.:
  - Sensors/radars on moveable UAVs, a/c, ships, ...
  - Human teams (RHIB, MSPF, RECC, etc.)
  - Weapons, and/or weapon systems
- Used to "process" or "execute" tasks (detect, observe, sense/measure, attack the bad-guys)
- Owned and controlled by individual Decisionmakers
  - Transfer among DMs is not allowed in this expt
- ***Characteristics:*** velocity, sensor and attack ranges, resource capabilities, ...

DDD Basics: **Asset-to-Task Mapping**

- Asset description includes
  - Ranges: e.g., UAV can detect ground tasks at range of 18nm, sea tasks at 20nm, etc.
  - Context: UAV can measure the presence of Refugees and Weapons in a Fishing Village, but not the Crowd composition
  - Attack capabilities: HA/DR, Fires, SUW, S&R, VBSS ...
  - Volume: e.g., AV8B & AH-1s each have 1 shot; XH30s, RHIBs have ∞ number (for ease of play)
- Task description includes
  - Requirements for successful task attack (VBSS, FProt, ..)
- Determines feasible asset-to-task assignments
  - Which asset (packages) can be used to attack which tasks

DDD Basics: **Sensing** (1)

- **Sensors** allow you to measure **attributes** of tasks
- There will be many concurrent tasks that require ISR
- However, not all *assets* measure all *attributes* of all *tasks.* You may need more than one asset to get the information For example:
  - Maritime Special Purpose Force (MSPF) can gather intel on Fishing Boats, but not Fishing Villages
  - The MEU RECC team can measure the crowd composition in a refugee camp, but cannot detect the presence of weapons. (You'll need a UAV or other air asset for that!)
- Different assets have different sensor ranges.
  - Range rings will display how close you'll need to be to a task for detection, measuring, attacking.

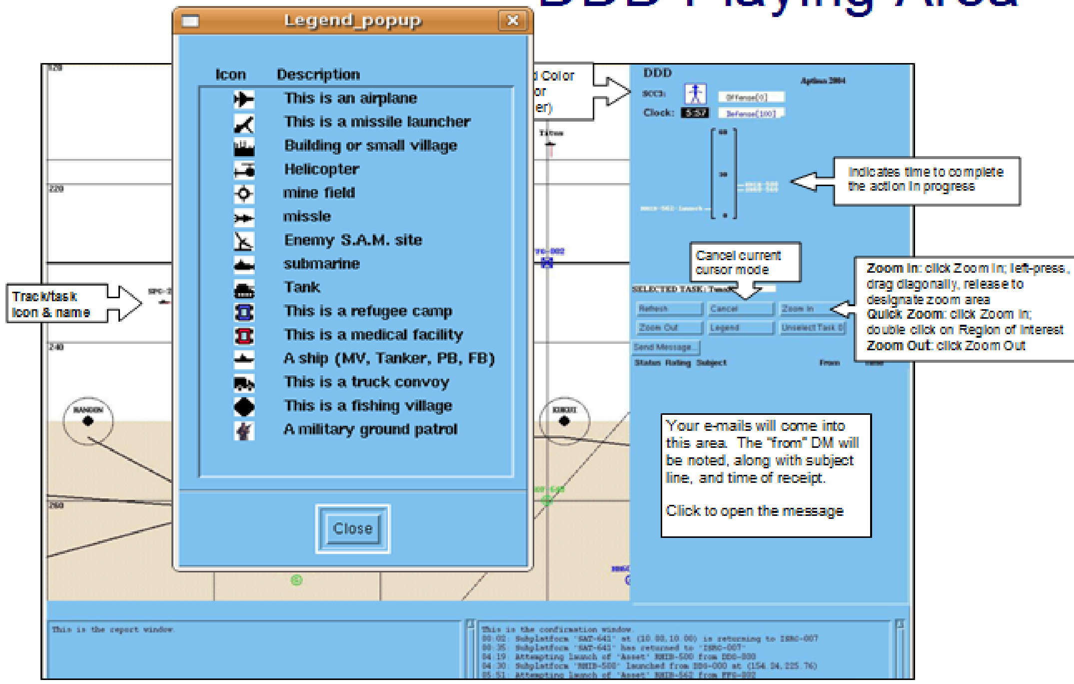
DDD Basics: **Sensing** (2)

- The first time your asset gets within sensor range of a task, an ISR (pop-up) message will appear on screen
- Refer to the Info_on_Task window to see the results of the team's ISR sensing efforts.
  - Sometimes you may need to move your asset quite close to get the needed intel
  - The Info_on_Task window can be viewed by any DM, at any time, to see what info has been obtained to date, and the times at which measurements were made
- You will also receive periodic e-mail messages within the DDD with intelligence reports and other critical info.
  - Follow-up on these reports by heeding given instructions

DDD Basics: **Organization**

- **Commanders** who
  - **Control ("own") assets**
  - Make decisions on what task to do, when, and with what assets – a "**plan**"
  - Need to communicate to synchronize assets and decide on task selection and asset allocation
- **Coordinators** who
  - Do not "own" any assets, but
  - Coordinate overall ISR requirements in the AOR
  - Strive to assure periodic updates on ISR tasks
  - Deconflict asset scarcity problems

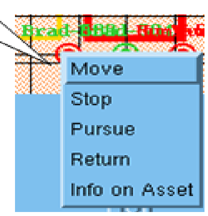
DDD Playing Area



Asset Control & Information

- *Right click* (and hold) on task entities to see options for control
- The most common options to manipulate assets:
  - Move
  - Stop moving (orbit in place)
  - Return to base
  - Info on Asset to display information on the selected asset (resources, subplatforms, weapons, fuel remaining, etc)

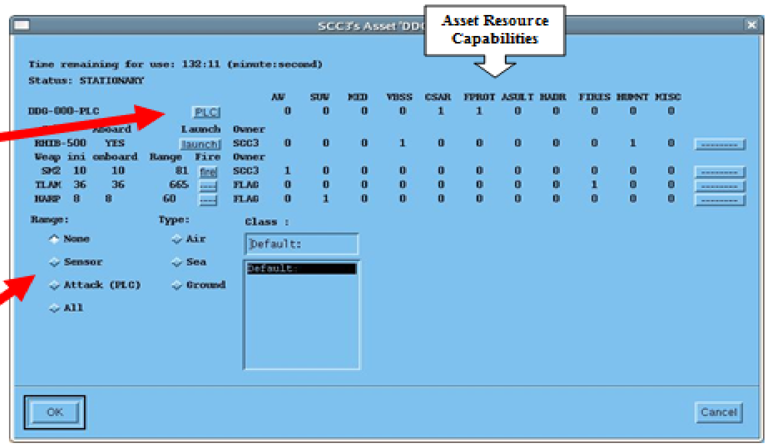
Right click on the asset, base etc. to see the pop-up menu. Choose the action you wish to commit.



Information on Assets

Right click on task icon and select Info on Asset to open the info window.

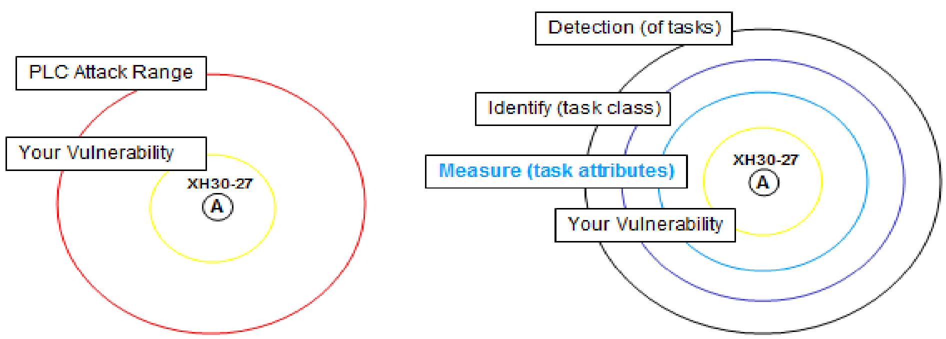
PLC*: use asset to attack
Launch: launch subplatform



Range Rings Display:
Click toggle buttons to enable/disable display of rings for specific classes of targets (listed in the type column). These rings will show up immediately on the map.

* **PLC** = "Platform's Local Capability"

Understanding Range Rings

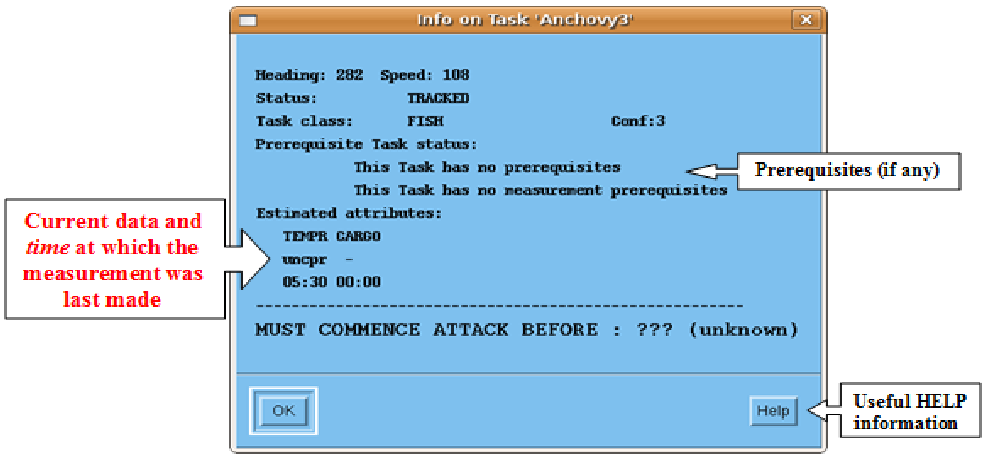


Weapon Range Rings **Sensor Range Rings**

- You can display some, all, or none of these rings...
  - Via the "Info on Asset" pull-down menu and window
  - They help you to know when tasks are in detection range, measurement range, attack range, etc...

Information on Tasks

- To see attributes and resource requirements for a task, *right click* on the task icon and select Info_on_Task to open an information window



Information on Tasks

- Refer to the ZIPPOS for attribute and processing requirements
- The ZIPPOS include a host of critical information including:
  - Specific indication of which attributes need to be measured
  - Instructions on how to process each of the task classes

Example: Fishing Villages

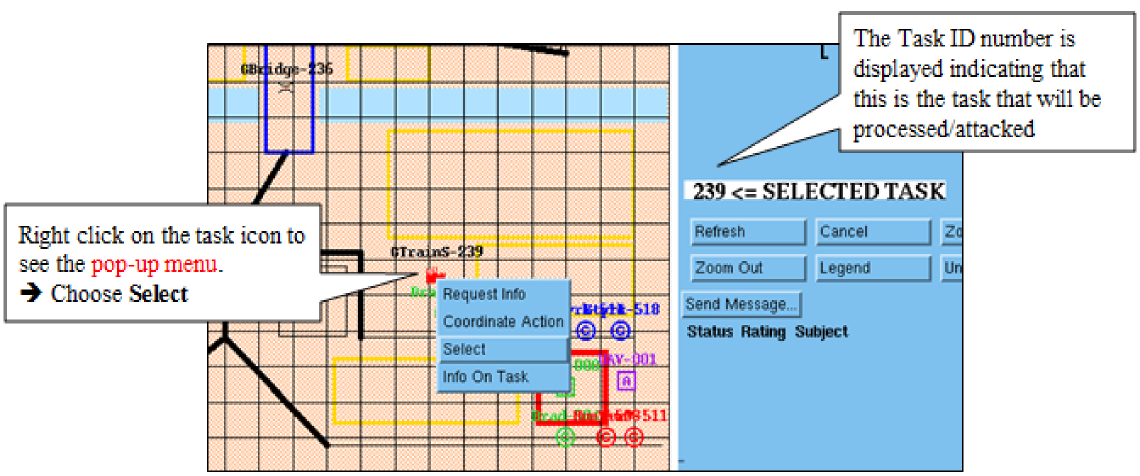
1. Scan all fishing villages with airborne and ground assets to learn if **refugees** are present, if **weapons** are present, and the composition of the **crowd** (normal, protestors, terrorists, …)
2. Report any changes in village status to the ESG-CDR ("FLAG")
3. Continue to monitor the village, not letting any attribute measurement become "stale" by more than 15mins.
4. When **terrorists** and **weapons** are present in a village, a strike is authorized.
   - If **refugees** are present attack with **RECC** *and* **LCAC** or **LCU**
   - If **refugees** are not present attack with **RECC** *and* **AH-1** or **AV8B**

Determining How to Process a Task

- Refer to the ZIPPOS for attribute and processing requirements
- The ZIPPOS include a host of useful information including:
  - Specific indication of which attributes need to be measured
  - Instructions on how to process/attack each task depending on its attribute value(s)

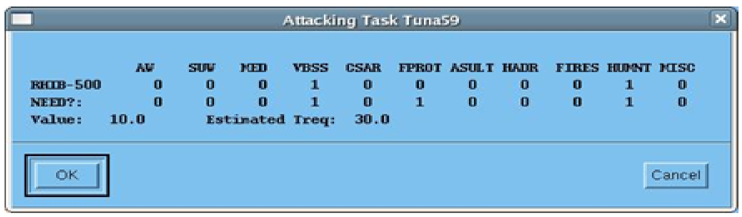
Selecting a Task to be Attacked

- Right click (and hold) on task icon, choose Select from the pop-up menu
- The task ID number/name appears above the action buttons and this is the task that will be processed by the asset(s) you choose



Attacking the Task

- Once the task is selected
  - Right click on the *asset(s)* you wish to use and select “Info on Asset”
  - Click “PCL” in the Info on Asset window
  - When ready, click “OK” in the attack confirmation pop-up
- Important: The task must be within your *asset’s attack* range ring and you must “own” the asset.



Voice Communications

- You will be able to communicate with the other participants over a voice channel
  - Share information, coordinate use of assets, ...
- You will all be on one channel
  - **SCC**: Sea Combat Commander
  - **MEU**: Marine Unit Commander
  - **ISRC**: ISR Coordinator or Commander
  - **FLAG:** ESG Commander is the experiment controller
- There will be no CHAT, e-mail, electronic communications.
- Follow net discipline, state call signs, etc.

DDD Training: Conclusion

- This covers the basics of DDD UI navigation
- Individual teams will decide their own role assignments: Who will be SCC, MEU or ISRC
- The next step is a DDD buttonology training run
  - in your first lab session
  - The training is self-paced
- Experimenters will sit with you and walk you through the steps and answer any questions

Thank You

APPENDIX C OPERATION ENSURING HOPE

OPERATION ENSURING HOPE

<u>Time</u>: August 2011
<u>Location</u>: Off the coasts of Asiland and Bartola (deepwater sea)

<u>Geo-Political Situation</u>

Thirty days ago the country of Asiland was struck by a Tsunami that caused massive damage to the country's infrastructure as well as incalculable losses to her civilian populace. Following the tsunami, a lack of response from the Asiland government to the disaster has resulted in multitudes of Asiland citizens fleeing south looking for help and better conditions. The southern exodus, which was both by land and sea, quickly overwhelmed the meager resources of Asiland. Moreover, when the tsunami hit, Asiland's governance was already more in the hands of terrorist and guerilla/drug cartel organizations than Asiland's elected representatives; this situation has degraded even more since.

As waves of refugees streamed south, they came to realize that real help and assistance was in the neighboring country of Bartola, whose intact infrastructure and strong western ties made it the natural springboard for relief efforts. Within days the guerillas and other terrorist factions in and around Asiland began to take advantage of the situation by migrating their operations to Bartola. These groups openly robbed relief sites and workers, raped and murdered refugees gathered along the coast, and accosted local and international shipping.

The United States was invited by the Bartola government to provide humanitarian and disaster relief assistance to Bartola and the organizations operating within it. ESG-7 based around the USS ESSEX was dispatched to the region to assume these tasks.

ESG-7 arrived three days ago. The vessels of the ESG have spent that time positioning themselves in the waters around Bartola and Asiland and slowly developing operational picture for both the land and sea situations. Major sea and air lanes were identified, as well s several major ports, villages, and cities. The ESG then placed forces where they would best support what the ESG staff believed were their upcoming land and sea operations.

A day after the arrival of ESG-7 Bartola officials reported a large uprising in the southwest area of Bartola. Insurgents, now supported by groups from Asiland have begun to wrest control of the area from Bartola's forces. Bartola's military units shifted to the southwest to counter, but this merely led to a total loss of control of the refugee situation along the northern border. Intelligence suggests that terrorist or cartel forces, supported by dissident groups in Bartola and Asiland, may be making a concerted effort

to wrest control of the government. It was also reported that several oil tankers and cargo ships were accosted by local pirates. The government of Bartola has requested United States forces to assist them in putting down the insurgency in the southwest. The United States has agreed, and has deployed the bulk of 31st MEU forces to support Bartola's counterinsurgency actions.

Bartola's military patrols are overwhelmed with tracking and locating the large numbers of refugee boats, as well as locating the terrorist and cartel operatives using refugee boats for illegal transfers. Furthermore, Bartola intelligence shared information that several coastal defense missile launch sites once located in Asiland are missing. Bartola intelligence believes that some of these launchers may have been moved to new locations, possibly, Haven Island. There is also a strong possibility that Haven Island is being used as a pirate base for local terrorist and insurgent groups. Bartola has requested the assistance of the United States and in assisting with the situation at sea. The neighboring country to the east, Cathal, has neither resources nor the political/military will to become involved or assist in the current situation.

Organization

ESG: 4 UAVs	SCC:	1 RHIB (on DDG)	MEU:	1 AV8B (on LHA)
		1 RHIB (on CG)		1 AH-1 (on LHA)
		2 XH30 (on FFG)		2 XH30 (on LHA)
		1 LCU (on FFG)		1 MSPF (on LSD)
		2 LCAC (on LSD)		1 MSPF (on LPD)
		2HH60 (on LHA)		4 RECC (in Bartola)

Note 1: XH30s are conceptual/advanced multi-purpose helos that combine the capabilities of an SH60 and UH-1, and are deployable for both sea and ground missions.

Note 2: Depending on the organizational structure, the 4 UAVs will either be owned by an ISR Commander or owned 2 each by the SCC and MEU.

ESG Commanders Intent

ESG-7 will operate under the concept of Adaptive Command and Control. ESG-7 is one team, one fight. Remember that while your warfare area is assigned to its traditional 'lane of responsibility' we are an AC2 force. Everyone must be ready to adapt and overcome. Look to and assist your fellow sailors and marines -- we are here for a single purpose. Advice is not criticism, assistance is not grandstanding. The people of this region need our help, and our country and the world expect us to give it to them. As one team, let's shove off, advance forward and accomplish the mission.

Our mission:

1. Support the country and government of Bartola by providing security and logistic support.
2. Provide humanitarian assistance and security to refugees of Asiland.
3. Protect own forces, Bartola property and vessels, and property of countries friendly to US interest in the operating area. Be prepared to conduct armed intervention against acts of piracy and open aggression.
4. Be perceived as a neutral humanitarian force supporting restoration of public welfare.

Rules of Engagement

1. US forces may engage any surface or ground unit that has initiated an attack or demonstrated hostile intent toward US, coalition, NGO or civilian personnel or interests.

Note: An attack by one unit or formation does NOT automatically constitute criteria for engagement of a separate, non-attacking/non-hostile intent unit or formation.

2. Nothing in these rules should be construed as relieving individual commanders of the responsibility for self-defense of ship, forces under tactical command/control or forces meeting friendly force criteria.

3. Strikes against oil tankers and merchant vessels are not authorized, only protection against attack. Report any changes in status or actions taken against these ships by hostile forces.

4. Closely monitor the situation in all refugee camps in Bartola. However, strikes on refugee camps are not authorized.

CURRENT OPERATION 0600-2359

ESG 7'S RESPONSIBILITIES

SCC Responsibilities:

1. **Sea Search and Rescue:** Conduct as necessary.
2. **ISR Taskings from Higher Authority**: Complete these tasks as requested.
3. **Fishing Boats:** Measure attributes of cargo and temperament initially, and after any port visit or after contact with another vessel. Take action according to ZIPPO.
4. **Merchant Vessels:** Measure attributes of cargo and status initially, and reassess periodically. Especially reassess each attribute after any port visit

and when merchant vessels come in contact with another vessel. Take action according to ZIPPO.

5. **Oil Tankers:** Conduct initial assessment of status and revisit periodically. Take action according to ZIPPO.
6. **Patrol Craft:** Monitor country of detected patrol craft periodically to determine if any patrol craft becomes bandit. Take action according to ZIPPO.
7. **Coastal Defense Launchers** (CDL): Locate CDLs with UAVs. If intelligence indicates a CDL is hostile, take action according to ZIPPO.
8. **Coordinate with MEU and ISRC as needed**.

MEU Responsibilities:

1. **ISR Taskings from Higher Authority:** Complete these tasks as requested.
2. **Buildings:** Measure attributes of activity and temperament and reassess every 15-20 minutes. Take action according to ZIPPO.
3. **Coastal Defense Launchers** (CDL): If intelligence indicates a located CDL is hostile, take action according to ZIPPO.
4. **Fishing Villages:** Measure attributes of refugees, weapons and crowd and reassess every 15 minutes. Take action according to ZIPPO.
5. **Ground Search and Rescue:** Find location of party with a UAV and conduct rescue. Coordinate with SCC according to ZIPPO.
6. **Military Ground Patrols**: Measure attribute of country upon first appearance and periodically afterwards. Take action according to ZIPPO.
7. **Refugee Camps:** Measure attributes of weapons and crowd and reassess every 15 minutes and not to exceed 15 minutes. Take action according to ZIPPO.
8. **SAM Sites:** Locate SAM sites with UAVs. Take action according to ZIPPO.
9. **Truck Convoys:** Locate with any air asset. Measure attributes of country and cargo upon first appearance and reassess every 15-20 minutes afterwards. Take action according to ZIPPO.
10. **Coordinate with SCC and ISRC as needed**.

ISR *Commander* Responsibilities:

1. Control high-value ISR assets (UAVs).
2. ISR Taskings from Higher Authority: Conduct as necessary.
3. Coordinate with SCC and MEU: Synchronize asset utilization. Work together on task selection and resource allocation.
4. Monitor e-mail and intel messages, including ISR tasking from higher authority.
5. Strive for efficiency in the use of ISR assets.

ISR *Coordinator* Responsibilities:

1. De-conflict asset scarcity problems.
2. Monitor tasks to assure periodic updates and assessments are current.
3. Coordinate with SCC and MEU: Synchronize asset utilization. Work together on task selection and resource allocation.
4. Monitor e-mail and intel messages, including ISR tasking from higher authority.
5. Strive for efficiency in the use of ISR assets.

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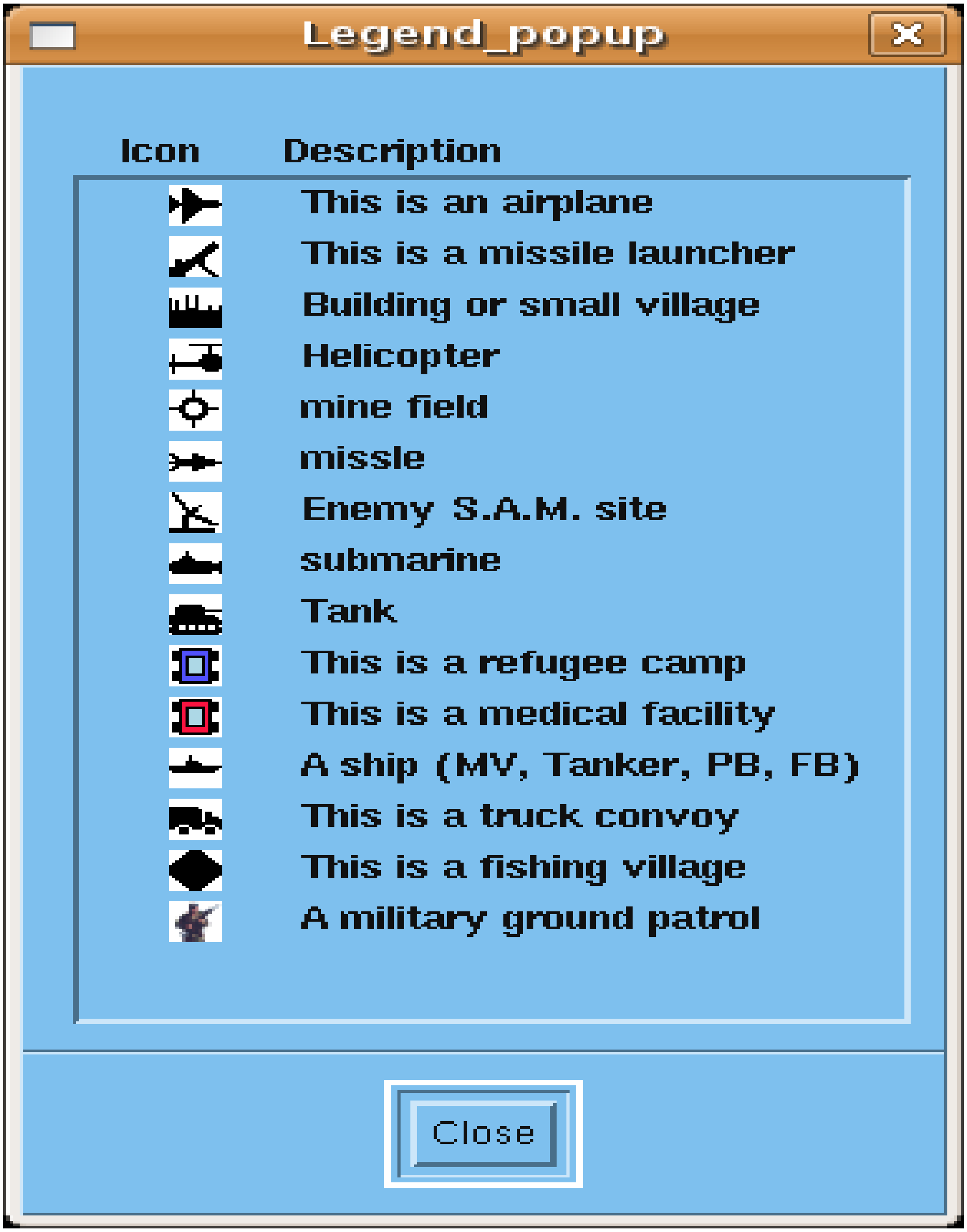
APPENDIX D LEGEND



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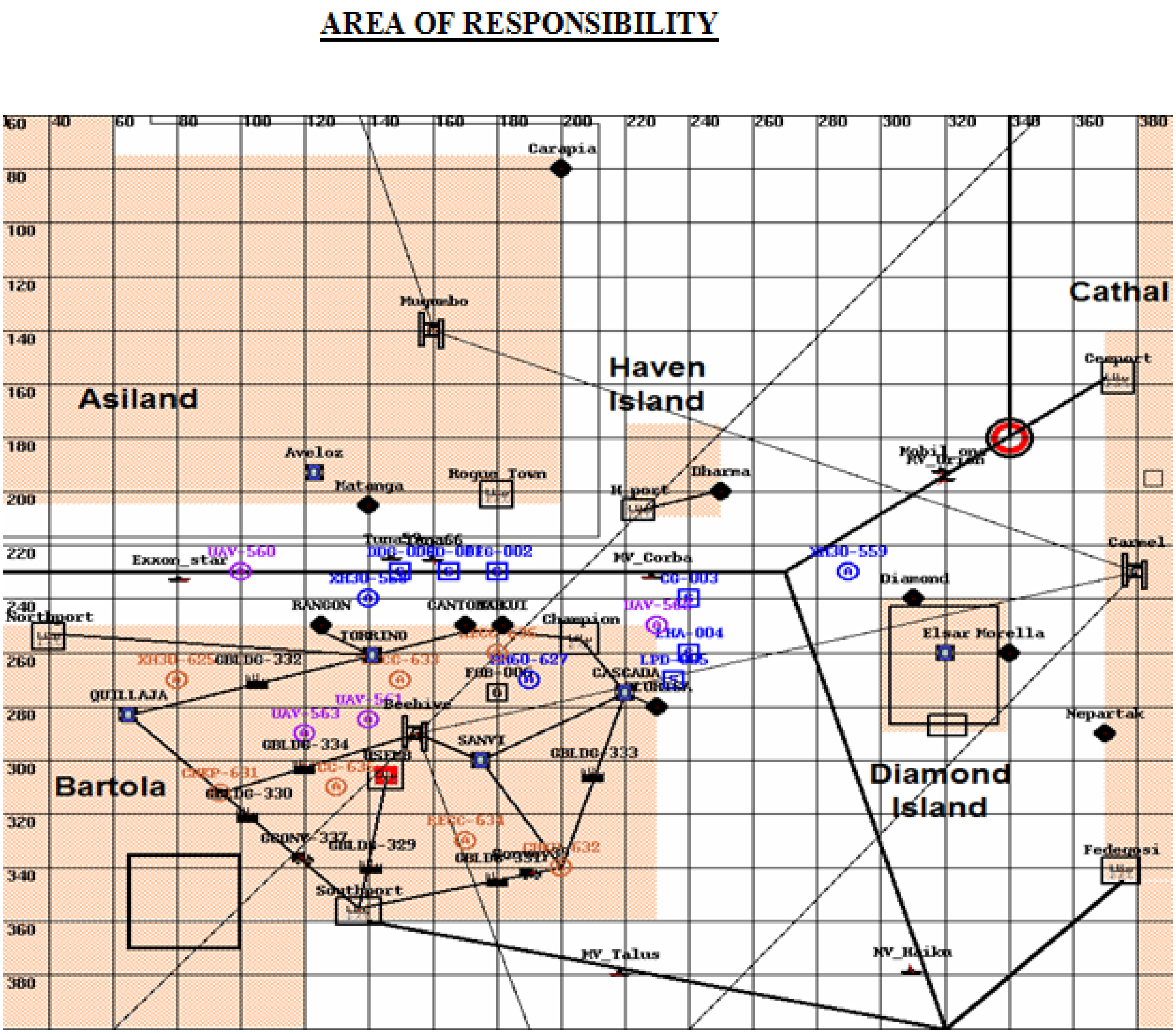
APPENDIX E AREA OF RESPONSIBILITY



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APPENDIX F ASSET ACRONYMS

Asset Acronyms (1 of 2)

CG: **Guided Missile Cruiser**, large combat vessels with multiple target response capability. They perform primarily in a battle force role and are multi-mission surface combatants capable of supporting carrier battle groups, amphibious forces, or of operating independently and as flagships of surface action groups.

DDG: **Guided Missile Destroyer**, fast warships that help safeguard larger ships by operating in support of carrier battle groups, surface action groups, amphibious groups and replenishment groups. Guided missile destroyers are multi-mission surface combatants which are also able to provide naval gun fire support.

FFG: **Guided Missile Frigate**, anti-submarine warfare combatants with an additional anti-air warfare capability.

LPD: **Landing Platform Dock**, embarks, transports and lands elements of a landing force for expeditionary warfare missions.

LSD: **Landing Ship Dock**, transports and launches amphibious crafts and vehicles with their crews and embarked personnel. They are mainly used to carry Landing Craft Air Cushions (LCACs), as well as carrying United States Marines.

LHA: **Amphibious Helo Assault Ship**, employed to land and support ground forces on enemy territory by an amphibious assault.

LCU: **Landing Craft Utility**, used by amphibious forces to transport equipment and troops to the shore. They are capable of transporting tracked or wheeled vehicles and troops from amphibious assault ships to beachheads or piers.

LCAC: **Landing Craft Air Cushioned**, transports, ship-to-shore and across the beach, personnel, weapons, equipment, and cargo of the assault elements of the Marine Air-Ground Task Force.

RHIB: **Rigid Hull Inflatable Boat**, is a light-weight but high performance and high capacity boat constructed with a solid, shaped hull and flexible tubes at the gunwale. The design is stable and seaworthy. The inflatable collar means that buoyancy is not lost if a large quantity of water is shipped aboard.

Asset Acronyms (2 of 2)

MSPF: **Maritime Special Purpose Force**, a task-organized force formed from elements of a Marine expeditionary unit (special operations capable) and naval special warfare forces that can be quickly tailored to a specific mission. The maritime special purpose force can execute on short notice a wide variety of missions in a supporting, supported, or unilateral role. It focuses on operations in a maritime environment and is capable of operations in conjunction with or in support of special operations forces.

RECC: **Reconnaissance Team**, highly trained military units designed to conduct specialized operations such as reconnaissance, unconventional warfare, and counter-terrorism actions

AV-8: **Light Attack Aircraft (Harrier)**, primary mission is to provide responsive close air support for the ground forces. This single-piloted, advanced vertical/short takeoff and landing aircraft can operate from short fields, forward sites, roads and surface ships providing minimum response time to targets.

AH-1: **Cobra Helicopter Gunship**, primary mission attack and close support.

HH60: Helicopter, medium-range search and rescue (SAR), drug interdiction, cargo lift and special operations. Significant ISR capabilities.

XH30: **Advanced Concept Multi-Purpose Helicopter**, used for anti-submarine warfare, search and rescue, drug interdiction, anti-ship warfare, cargo lift, special operations, MedEvac, command and control, air assault, personnel and materiel transport and as gun ships.

UAV: **Unmanned Aerial Vehicle**, is an aircraft with no onboard pilot. UAVs can be remote controlled or fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs are currently used in a number of military roles, including reconnaissance and attack.

APPENDIX G ASSET CAPABILITY FOR MEASURING TASK ATTRIBUTES SHEET

	Fishing Village			Refugee Camp		Building		Truck Convoy		Grnd Patrol	Fishing Boat		Oil Tanker	Merchant Vessel		Patrol Craft
	A1	A2	A3	A1	A2	A1	A2	A1	A2	A1	A1	A2	A1	A1	A2	A1
	Refugees	Weapons	Crowd	Weapons	Crowd	Temperament	Activity	Cargo	Country	Country	Temperament	Cargo	Status	Cargo	Status	Country
UAV	15	15		15			15		15			12		12		12
MSPF											5	5	5	5	5	5
RECC	4		4		4	4		4	4	4						
XH30	4	4		4			4		4	4	10		10		10	10
HH60	4		4		4	4		4	4	4	6		6		6	6
XH30	4	4		4			4		4	4	10		10		10	10
RHIB											5	5	5	5	5	5
Ships											2		2		2	2

Notes: Numbers in the cells above denote attribute measurement ranges

Primary assets for detection are UAVs, XH30s, HH60s, AV8s and AH1s

AV8s, AH1s, LCACs and LCU have no measuring capabilities

MEU

LHA: AV8 (1)
LHA: AH1 (1)
LHA: XH30 (1 of 2 launched)
LSD: MSPF (1)
LPD: MSPF (1)
Bartola at FOB: RECC (4 of 4 deployed)

SCC

DDG: RHIB (1)
CG : RHIB (1)
FFG: XH30 (2 of 2 launched)
LPD: LCU (1)
LSD: LCAC (2)
LHA: HH60 (1 of 2 launched)

UAVs: 4 of 4 launched

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APPENDIX H ZIPPOS

At Sea Search and Rescue (SOS) ZIPPOS

Once....	Action
Location of SOS is reported	Dispatch HH60 to rescue survivors

Building (GBLDG) ZIPPOS

- **Reassess every 15-20 minutes**

Activity	Temperament	Action
Normal Activity 	**Any**	Continue to monitor
Suspicious Activity 	Friend Uncooperative	Continue to monitor
	Hostile	**Strike:** AV8 **OR** AH1

Coastal Defense Missile Launcher (CDL) ZIPPOS

If....	Action
Intelligence indicates that CDL is hostile (engaged in terrorist or insurgent activity)	**Strike:** AV8 **OR** AH1

Fishing Boat ZIPPOS

- Reassess attributes after each port visit or after contact with another vessel

Cargo	Temperament	Action
Drugs Food Refugees No Cargo	ANY	Report to **ESG CDR**
Weapons Unknown	Friend Uncooperative	VBSS: RHIB **OR** MSPF AND XH30 **OR** Any Ship **OR** AH1
	Hostile	ESG Level VBSS: MSPF AND XH30 **OR** Any Ship

Fishing Village ZIPPOS

- **Reassess all three attributes every 15 minutes**

Refugees	Weapons	Crowd	Action
No Refugees	No Weapons	**Any**	Report crowd status to **ESG CDR**
	Weapons	Terrorists	**Strike:** RECC **AND** AH1 **OR** AV8 **MEU:** Reassess village upon completion of strike
		No Terrorists	Report information to **ESG CDR**
Refugees	No Weapons	**Any**	Report presence of refugees to **ESG CDR**
	Weapons	Terrorists	**Relief:** RECC **AND** LCAC **OR** LCU
		No Terrorists	Report presence of refugees to **ESG CDR**

Ground Search and Rescue (GS&R) ZIPPOS

- **UAVs must be used to locate and must maintain illumination of GS&R until rescue is completed**

Once...	Action
Location of GS&R is determined	Dispatch HH60 to rescue survivors

Merchant Vessel ZIPPOS

- **Reassess periodically**
- **Especially reassess each attribute after any port visit and when merchant vessel comes in contact with another vessel**

Cargo	Status	Action
Drugs Food Refugees No Cargo	Hijacked Transit Harrassed Distress	**SCC:** Ships carrying relief supplies should be closely monitored to ensure that they are protected from bandit patrol craft or coastal missile attack Report any unusual status to **ESG CDR** immediately
Weapons		Report to **ESG CDR** and **MEU** Report cargo if vessel pulls into a Bartola port Report any unusual status to **ESG CDR** immediately

Military Ground Patrol (GMGP) ZIPPOS

- Measure upon first appearance and periodically afterwards
- Locate with any air asset
- Ctry B = Bartola
- unknw = unknown

Country	Action
Bartola unknw	Report to **ESG CDR**
Insurgents	**Strike:** AH1, AV8 **OR** XH30

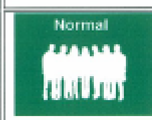
Oil Tanker ZIPPOS

- **Conduct initial assessment**
- **Revisit periodically**

Status	Action
Transit	None
Distress	Report information to **ESG CDR**
Harrassed	Report information to **ESG CDR** This may be a sign that insurgents or bandit patrol boats may be operating in the area requiring additional vigilance by **SCC**
Hijacked	Report information to **ESG CDR**

Refugee Camp ZIPPOS

- Reassess both attributes every 15 minutes (do not allow any attribute measurement to be more than 15 minutes old)

Weapons	Crowd	Action
No Weapons 	**Any**	Reassess every 15 minutes and report to **ESG CDR**
Weapons 		**A strike is NOT authorized** **MEU/SCC:** Report information **to ESG CDR** for further action Reassess every 15 minutes
	 	Reassess every 15 minutes and report to **ESG CDR**

SAM Sites (GSAM) ZIPPOS

- **SAM sites must be located by UAVs**
- **UAV must continue to illuminate SAM site until strike is complete**

If...	Action
SAM site is located	AV8s are the only aircraft capable of destroying them, but require a UAV to laser designate for them **Strike:** AV8 **AND** UAV

Truck Convoy (GCONV) ZIPPOS

- Measure upon first appearance and every 15-20 minutes afterwards
- Locate with any air asset
- Ctry B = Bartola
- Unpkp = UN Peace Keeping

Country	Cargo	Action
Bartola Unpkp	Any	Monitor for protection against possible takeover by insurgents
Insurgents	No Weapons	Report to **ESG CDR** to determine the best course of action
Insurgents	Weapons	**Strike:** AV8, AH1 **OR** XH30

APPENDIX I TASK DESCRIPTION

Task Description

1. **At Sea Search and Rescue (SOS)**

a. SOS are time critical events that must be dealt with immediately to avoid political, other public relations repercussions or the loss of lives. This is normally a result of a ship having been attacked or having hit a mine.

b. Once location of the SOS is reported…then dispatch an HH60 to rescue survivors.

2. **Buildings (GBLDG)**

a. Buildings are located along major roads and have the potential to serve as basing stations by terrorists and insurgents.

b. Monitor and reassess the following attributes every 15-20 minutes:
- Temperament (any, friend, uncooperative or hostile)
- Activity (normal or suspicious)

c. Attributes may be measured with the following:
- Temperament – RECC and HH60
- Activity - UAV or XH30

d. How to perform task is as follows:
- If normal activity and any temperament…then continue to monitor
- If suspicious activity and friend…then continue to monitor
- If suspicious activity and uncooperative…then continue to monitor
- If suspicious activity and hostile…then strike with AV8 **or** AH1

3. **Coastal Defense Missile Launchers (CDL)**

a. Pirated CDLs pose a threat to U.S. and international shipping in the region. CDLs are not considered hostile until designated hostile by the ESG CDR. If the ESG CDR obtains intel showing CDLs to be used against shipping, the ESG CDR shall order them located and destroyed.

b. If intelligence indicates that CDL is hostile (engaged in terrorist or insurgent activity)…then strike with AV8 **or** AH1.

4. **Fishing Boats (FB)**

a. Fishing boats are vehicles that transport refugees, terrorist and weapons.

b. Monitor and reassess the following attributes after every port visit or after contact with another vessel:

- Temperament (any, friend, uncooperative or hostile)
- Cargo (drugs, food, refugees, no cargo, weapons and unknown)

c. Attributes may be measured with the following:

- Temperament – MSPF, XH30, HH60, RHIB or Ships
- Cargo – UAV, MSPF or RHIB

d. How to perform task is as follows:

- If drugs and any temperament…then report to ESG CDR
- If food and any temperament…then report to ESG CDR
- If refugees and any temperament…then report to ESG CDR
- If no cargo and any temperament…then report to ESG CDR
- If weapons and friend…then conduct VBSS with RHIB **or** MSPF **and** XH30 **or** any ship or AH1
- If weapons and uncooperative… then conduct VBSS with RHIB **or** MSPF **and** XH30 **or** any ship or AH1
- If unknown cargo and friend… then conduct VBSS with RHIB **or** MSPF **and** XH30 **or** any ship or AH1
- If unknown cargo and uncooperative…then conduct VBSS with RHIB **or** MSPF **and** XH30 **or** any ship or AH1
- If weapons and hostile…then conduct ESG level VBSS with MSPF **and** XH30 **or** any ship
- If unknown cargo and hostile… then conduct ESG level VBSS with MSPF **and** XH30 **or** any ship

5. **Fishing Villages (FV)**

a. The four fishing villages on Bartola are the major points of departure and entry of refugees, terrorists/insurgents (mingled within the refugees) and weapons through the use of the large local fishing fleet.

b. Monitor and reassess the following attributes every 15 minutes:

- Refugees (refugees or no refugees)
- Weapons (weapons or no weapons)
- Crowd (any, terrorists or no terrorists)

e. Attributes may be measured with the following:
  - Refugees – UAV, RECC, XH30 or HH60
  - Weapons – UAV or XH30
  - Crowd – RECC or HH60

f. How to perform task is as follows:
  - If no refugees, no weapons and any crowd… then report crowd status to ESG CDR
  - If no refugees, weapons and terrorists… then strike with a RECC **and** AH1 **or** AV8. MEU must reassess village upon completion of strike.
  - If no refugees, weapons and no terrorists…then report information to ESG CDR.
  - If refugees, no weapons and any crowd…then report presence of refugees to ESG CDR.
  - If refugees, weapons and terrorists…then report to ESG CDR (**urgent**)
  - If refugees, weapons and no terrorists…then report presence of refugees to ESG CDR.

6. **<u>Ground Search and Rescue (GS&R)</u>**

a. GS&Rs are time critical events that must be dealt with immediately to avoid political, other public relations repercussions or the loss of lives.

b. UAVs must be used to located and must maintain illumination or GS&R until rescue is completed.

c. Once location of the GS&R is reported…then dispatch an HH60 to rescue survivors.

7. **<u>ISR Request</u>**

a. These are pop-up requests from higher authority to conduct a time critical mapping at a specified location.

b. Only a UAV may be used to complete this task.

8. **<u>Merchant Vessels</u>**

a. Merchant vessels travel the known sea lanes carrying cargo to multiple international destinations. Several merchants deliver relief supplies and unfortunately smuggle weapons to terrorist groups in the country.

b. Current ROE forbids VBSS action against any merchant vessel in the AOR.

c. Monitor and reassess periodically for the following attributes:
   - Cargo (drugs, food, refugees, no cargo or weapons)
   - Status (hijacked, transit, harassed or distressed)

d. Especially reassess each attribute after any port visit and when merchant vessel comes in contact with another vessel.

e. Attributes may be measured with the following:
   - Cargo – UAV, MSPF or RHIB
   - Status – MSPF, XH30, HH60, RHIB or Ships

f. How to perform task is as follows:
   - If drugs, food, refugees **or** no cargo **and** hijacked, transit, harrassed **or** distresss…then ships carrying relief supplies should be closely monitored to ensure they are protected from bandit patrol craft or coastal missile attack.
   - If weapons **and** hijacked, transit, harassed **or** distressed…then report to ESG CDR and MEU. Report cargo if vessel pulls into a Bartola port.
   - Report any unusual status to ESG CDR immediately.

9. **Military Ground Patrol (GMGP)**

a. Numerous ground patrols are active throughout Bartola. Insurgents and bandits are also moving about the country and may pose as ground patrol.

b. Locate with any air asset.

c. Measure upon first appearance and periodically afterwards:
   - Country (Bartola, unknown or insurgents)

d. Attributes may be measured with the following:
   - Country – RECC, XH30 or HH60

c. How to perform task is as follows:
   - If Bartola or unkown….then report to ESG CDR
   - If insurgents…then strike with AH1, AV8 or XH30

10. **Oil Tankers**

a. Oil tankers transit the sea lanes going to and from oil platforms near Cathal. They are potential targets for terrorist attacks and need to be protected.

b. Conduct initial assessment and revisit periodically to measure the following attributes:

- Status (transit, distress, harassed or hijacked)

c. Attributes may be measured with the following:

- Status – MSPF, XH30, HH60, RHIB or Ships

d. How to perform task is as follows:

- If transit…then no further action required
- If distress…then report information to ESG CDR
- If harassed…then report information to ESG CDR. This may be a sign that insurgents or bandit patrol boats may be operating in the area requiring additional vigilance by SCC
- If hijacked…then report information to ESG CDR

11. **Patrol Crafts**

a. Patrol crafts are utilized by Asiland, Bartola and Cathal. All patrol crafts are subject to being commandeered by terrorists/insurgents, who can use them to do things such as attack merchant vessels or oil tankers.

b. Monitor the following attributes periodically to ensure patrol craft does not become bandit:

- Country (Asiland, Bartola, Cathal or Insrugents)

c. Attributes may be measured with the following:

- Country – UAV, MSPF, XH30, HH60, RHIB or Ships

d. How to perform task is as follows:

- If Cathal…then no further action required
- If Bartola…then no further action required
- If Asiland…then monitor periodically to ensure patrol craft does not become bandit
- If Insurgents…then strike with XH30 **or** AV8

12. **Refugee Camps**

a. Four refugee camps are located in Bartola. They are the location of the greatest relief works being conducted and the ultimate destination of all refugees in the country.
There are several of these spread over the countries and islands. Four are in Bartola.

b. Reassess the following attributes every 15 minutes (do not allow any attribute measurement to be more than 15 minutes old):

- Weapons (no weapons or weapons)
- Crowd (any, terrorists, normal or protestors)

c. Attributes may be measured with the following:
- Weapons – UAV or XH30
- Crowd – RECC or HH60

d. How to perform task is as follows:
- If no weapons and any crowd…then reassess every 15 minutes and report to ESG CDR
- If weapons and terrorists…then a strike is not authorized. MEU and SCC report information to ESG CDR for further action. Reassess every 15 minutes.
- If weapons and normal…then reassess every 15 minutes and report to ESG CDR
- If weapons and protestors…then reassess every 15 minutes and report to ESG CDR

13. **SAM Sites (GSAM)**

a. All countries in the region have agreed to deactivate their SAM sites while the U.S. is conducting humanitarian operations. A few mobile sites have been reported stolen and have been commandeered by terrorists.

b. Must be located by UAVs.

c. UAV must continue to illuminate SAM site until strike is complete.

d. How to perform task is as follows:
- If SAM site is located…then strike with AV8 and UAV

14. **Truck Convoys**

a. Truck convoys transit throughout Bartola to deliver relief supplies and food shipments to refugee camps and fishing villages.

b. Locate with any air asset.

c. Measure the following attributes upon first appearance and every 15-20 minutes afterwards:
- Cargo (any, no weapons or weapons)
- Country (Bartola, Unpkp or Insurgents)

d. Attributes may be measured with the following:
- Cargo – RECC or HH60

- Country – UAV, RECC, XH30 or HH60

e. How to perform task is as follows:
    - If Bartola and any cargo…then monitor for protection against possible takeover by insurgents
    - If Unpkp and any cargo…then monitor for protection against possible takeover by insurgents
    - If insurgents and no weapons…then report to ESG CDR to determine the best course of action
    - If insurgents and weapons…then strike with AV8, AH1 or XH30

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APPENDIX J PLANNING SHEETS

GROUND PLANNING SHEET

FISHING VILLAGE	Refugees	Weapons	Crowd	REFUGEE CAMP	Weapons	Crowd	
Cantomar				Cascada			
Glorisa				Quillaja			
Kukui				Sanvi			
Rangon				Torrino			
BUILDING	**Temperament**	**Activity**	**TRUCK CONVOY**	**Cargo**	**Country**	**GROUND PATROL**	**Country**
GBLDG 329			Convoy 39				
GLBDG 330			GCONV-337				
GBLDG 331							
GBLDG 332							
GLBDG 333							
GBLDG 334							
GBLDG 335							

NOTES:

SURFACE PLANNING SHEET

FISHING BOAT	Temperament	Cargo	PATROL CRAFT	Country	MERCHANT VESSEL	Cargo	Status	OIL TANKER	Status
Tuna 59					Corba			Exxon_Star	
					Haiku			Mobile 1	
					Orion				
					Talus				

NOTES:

ISR CDR PLANNING SHEET

APPENDIX K MONITORING SHEETS

GROUND TASKS MONITORING SHEET SESSION III

Date:		Group:			
PHASE I (15 min exp clock time)			PHASE II (30 min exp clock time)		
Start Time			**Start Time**		
End Time			**End Time**		
Rangon	**Measurement**	**Time**	**Rangon**	**Time**	**Measurement**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
Torrino	**Measurement**	**Time**	**Torrino**	**Time**	**Measurement**
Weapons			Weapons		
Crowd			Crowd		
Cantomar	**Measurement**	**Time**	**Cantomar**	**Time**	**Measurement**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
Kukui	**Measurement**	**Time**	**Kukui**	**Time**	**Measurement**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
Cascada	**Measurement**	**Time**	**Cascada**	**Time**	**Measurement**
Weapons			Weapons		
Crowd			Crowd		
Glorisa	**Measurement**	**Time**	**Glorisa**	**Time**	**Measurement**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
BLDG 335	**Measurement**	**Time**	**BLDG 335**	**Time**	**Measurement**
Temp			Temp		
Activity			Activity		
BLDG 333	**Measurement**	**Time**	**BLDG 333**	**Time**	**Measurement**
Temp			Temp		
Activity			Activity		
Sanvi	**Measurement**	**Time**	**Sanvi**	**Time**	**Measurement**
Weapons			Weapons		
Crowd			Crowd		
BLDG 331	**Measurement**	**Time**	**BLDG 331**	**Time**	**Measurement**
Temp			Temp		
Activity			Activity		
BLDG 329	**Measurement**	**Time**	**BLDG 329**	**Time**	**Measurement**
Temp			Temp		
Activity			Activity		
BLDG 330	**Measurement**	**Time**	**BLDG 330**	**Time**	**Measurement**
Temp			Temp		
Activity			Activity		
Quillaja	**Measurement**	**Time**	**Quillaja**	**Time**	**Measurement**
Weapons			Weapons		
Crowd			Crowd		
	Measurement	**Time**		**Time**	**Measurement**

PHASE I	**PHASE II**
Numer of Tasks: ______	**Numer of Tasks: ______**
Number of Attributes: ______	**Number of Attributes: ______**
Number of Attributes *NOT* Measured: ______	**Number of Attributes *NOT* Measured: ______**

GROUND TASKS MONITORING SHEET SESSION III B

Date:		Group:
PHASE I (15 min exp clock time)		
Start Time		
End Time		
Rangon	**Time**	**Measurement**
Refugees		
Weapons		
Crowd		
Torrino	**Time**	**Measurement**
Weapons		
Crowd		
Cantomar	**Time**	**Measurement**
Refugees		
Weapons		
Crowd		
Kukui	**Time**	**Measurement**
Refugees		
Weapons		
Crowd		
Cascada	**Time**	**Measurement**
Weapons		
Crowd		
Glorisa	**Time**	**Measurement**
Refugees		
Weapons		
Crowd		
BLDG 333	**Time**	**Measurement**
Temperament		
Activity		
Sanvi	**Time**	**Measurement**
Weapons		
Crowd		
BLDG 331	**Time**	**Measurement**
Temperament		
Activity		
BLDG 329	**Time**	**Measurement**
Temperament		
Activity		
BLDG 330	**Time**	**Measurement**
Temperament		
Activity		
BLDG 334	**Time**	**Measurement**
Temperament		
Activity		
Quillaja	**Time**	**Measurement**
Weapons		
Crowd		
BLDG 332	**Time**	**Measurement**
Temperament		
Activity		
	Time	**Measurement**

PHASE I

Numer of Tasks: _______

Number of Attributes: _______

Number of Attributes *NOT* Measured: _______

GROUND TASKS MONITORING SHEET SESSION IV

Date: Group:

PHASE I (15 min esp clock time)			PHASE II (30 min esp clock time)		
Start Time			**Start Time**		
End Time			**End Time**		
Rangon	**Measurement**	**Time**	**Rangon**	**Measurement**	**Time**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
Torrino	**Measurement**	**Time**	**Torrino**	**Measurement**	**Time**
Weapons			Weapons		
Crowd			Crowd		
Cantomar	**Measurement**	**Time**	**Cantomar**	**Measurement**	**Time**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
Kukui	**Measurement**	**Time**	**Kukui**	**Measurement**	**Time**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
Cascada	**Measurement**	**Time**	**Cascada**	**Measurement**	**Time**
Weapons			Weapons		
Crowd			Crowd		
Glorisa	**Measurement**	**Time**	**Glorisa**	**Measurement**	**Time**
Refugees			Refugees		
Weapons			Weapons		
Crowd			Crowd		
BLDG 333	**Measurement**	**Time**	**BLDG 333**	**Measurement**	**Time**
Temperament			Temperament		
Activity			Activity		
Sanvi	**Measurement**	**Time**	**Sanvi**	**Measurement**	**Time**
Weapons			Weapons		
Crowd			Crowd		
BLDG 331	**Measurement**	**Time**	**BLDG 331**	**Measurement**	**Time**
Temperament			Temperament		
Activity			Activity		
BLDG 329	**Measurement**	**Time**	**BLDG 329**	**Measurement**	**Time**
Temperament			Temperament		
Activity			Activity		
BLDG 330	**Measurement**	**Time**	**BLDG 330**	**Measurement**	**Time**
Temperament			Temperament		
Activity			Activity		
BLDG 334	**Measurement**	**Time**	**BLDG 334**	**Measurement**	**Time**
Temperament			Temperament		
Activity			Activity		
Quillaja	**Measurement**	**Time**	**Quillaja**	**Measurement**	**Time**
Weapons			Weapons		
Crowd			Crowd		
BLDG 332	**Measurement**	**Time**	**BLDG 332**	**Measurement**	**Time**
Temperament			Temperament		
Activity			Activity		

PHASE I

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: ______

PHASE II

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: ______

GROUND TASKS MONITORING SHEET SESSION IV cont

Date: Group:

PHASE III (40 min exp clock time)

Start Time		
End Time		
Rangon	**Measurement**	**Time**
Refugees		
Weapons		
Crowd		
Torrino	**Measurement**	**Time**
Weapons		
Crowd		
Cantomar	**Measurement**	**Time**
Refugees		
Weapons		
Crowd		
Kukui	**Measurement**	**Time**
Refugees		
Weapons		
Crowd		
Cascada	**Measurement**	**Time**
Weapons		
Crowd		
Glorisa	**Measurement**	**Time**
Refugees		
Weapons		
Crowd		
BLDG 333	**Measurement**	**Time**
Temperament		
Activity		
Sanvi	**Measurement**	**Time**
Weapons		
Crowd		
BLDG 331	**Measurement**	**Time**
Temperament		
Activity		
BLDG 329	**Measurement**	**Time**
Temperament		
Activity		
BLDG 330	**Measurement**	**Time**
Temperament		
Activity		
BLDG 334	**Measurement**	**Time**
Temperament		
Activity		
Quillaja	**Measurement**	**Time**
Weapons		
Crowd		
BLDG 332	**Measurement**	**Time**
Temperament		
Activity		

PHASE III

Numer of Tasks: _______

Number of Attributes: _______

Number of Attributes *NOT* Measured: _______

SURFACE TASKS MONITORING SHEET SESSION III

Date: ✚ **Group:**

PHASE I (15 min exp clock time)			PHASE II (30 min exp clock time)		
Start Time			**Start Time**		
End Time			**End Time**		
MV Isadore	**Time**	**Measurement**	**Smelt 1**	**Time**	**Measurement**
Cargo			Temp		
Status			Cargo		
Exxon Star	**Time**	**Measurement**	**Turbot 3**	**Time**	**Measurement**
Status			Temp		
Tuna 59	**Time**	**Measurement**	Cargo		
Temp			**Mullet**	**Time**	**Measurement**
Cargo			Temp		
Mullet	**Time**	**Measurement**	Cargo		
Temp			**Exxon Star**	**Time**	**Measurement**
Cargo			Status		
SPC 291	**Time**	**Measurement**	**MV Taipei**	**Time**	**Measurement**
Country			Cargo		
MV Orion	**Time**	**Measurement**	Status		
Cargo			**Anchovy 3**	**Time**	**Measurement**
Status			Temp		
Anchovy 3	**Time**	**Measurement**	Cargo		
Temp			**Shark**	**Time**	**Measurement**
Cargo			Temp		
Mobile One	**Time**	**Measurement**	Cargo		
Status			**SPC 291**	**Time**	**Measurement**
			Country		
	Time	**Measurement**	**Anchovy 1**	**Time**	**Measurement**
			Temp		
			Cargo		
	Time	**Measurement**		**Time**	**Measurement**
	Time	**Measurement**		**Time**	**Measurement**
	Time	**Measurement**		**Time**	**Measurement**

PHASE I

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: _

PHASE II

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: ______

SURFACE TASKS MONITORING SHEET SESSION III B

Date: Group:

PHASE I (15 min exp clock time)

Start Time		
End Time		
MV China Star	Time	Measurement
Cargo		
Status		
SPC 291	Time	Measurement
Country		
Exxon Star	Time	Measurement
Status		
Tuna 65	Time	Measurement
Temp		
Cargo		
Tuna 59	Time	Measurement
Temp		
Cargo		
Tuna 66	Time	Measurement
Temp		
Cargo		
Salmon	Time	Measurement
Temp		
Cargo		
MV Corba	Time	Measurement
Cargo		
Status		
MV Orion	Time	Measurement
Cargo		
Status		
Whale 3	Time	Measurement
Temp		
Cargo		
Mobile One	Time	Measurement
Status		
	Time	Measurement
	Time	Measurement
	Time	Measurement

PHASE I

Numer of Tasks: ______

Number of Attributes: ______

Nmbr of Attributes *NOT* Measured: ____

SURFACE TASKS MONITORING SHEET SESSION IV

DATE: GROUP:

PHASE I (15 min exp clock time)		PHASE II (30 min exp clock time)	
Start Time		Start Time	
End Time		End Time	
MV Isadora	Time	Smelt 1	Time
Cargo		Temp	
Status		Cargo	
Exxon Star	Time	Turbot 3	Time
Status		Temp	
Tuna 59	Time	Cargo	
Temp		Mullet	Time
Cargo		Temp	
Anchovy 1	Time	Cargo	
Temp		Exxon Star	Time
Cargo		Status	
Mullet	Time	MV Taipei	
Temp		Cargo	Time
Cargo		Status	
SPC 291	Time	Anchovy 3	
Country		Temp	Time
MV Orion	Time	Cargo	
Cargo		Shark	Time
Status		Temp	
Anchovy 3	Time	Cargo	
Temp		SPC 291	Time
Cargo		Country	
Shark	Time		
Temp			
Cargo			
Mobile One	Time		
Status			
MV Taipei	Time		
Cargo			
Status			

PHASE I

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: ___

PHASE II

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: ______

SURFACE TASKS MONITORING SHEET SESSION IV cont

Date: Group:

PHASE III (45 min exp clock time)

Start Time		
End Time		
MV China St:	Measurement	Time
Cargo		
Status		
SPC 291	Measurement	Time
Country		
Exxon Star	Measurement	Time
Status		
Tuna 65	Measurement	Time
Temp		
Cargo		
Tuna 59	Measurement	Time
Temp		
Cargo		
Tuna 66	Measurement	Time
Temp		
Cargo		
Salmon	Measurement	Time
Temp		
Cargo		
MV Corba	Measurement	Time
Cargo		
Status		
MV Orion	Measurement	Time
Cargo		
Status		
Whale 3	Measurement	Time
Temp		
Cargo		
Mobile One	Measurement	Time
Status		

PHASE III

Numer of Tasks: ______

Number of Attributes: ______

Number of Attributes *NOT* Measured: ______

APPENDIX L DDD BUTTONOLOGY TRAINING

DDD Training Pointers to Cover During Buttonology Training

How to:

1) **Select target**
2) **Zoom in & out (2 ways)**
3) **Check what asset is located on platform**
4) **Put up range rings and their meaning:**
    a. **Black: Detect**
    b. **Dark blue: Identify (not use in this version)**
    c. **Light Blue: Measure**
    d. **Red: Attack**
    e. **Yellow: Be attacked**
    f. **"Stealth" info on certain tasks**
5) **Legend**
6) **Move, stop**
7) **Attack, using PLC**
8) **Info on task**
9) **Coordinate joint attack**

Help window

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APPENDIX M DEMOGRAPHIC SURVEY

Demographic Survey

Please provide us with a little information about yourself. This information will be used to help us better interpret the data we collected.

Date:	______________________	
Position Played:	______________________	
Age:	______________________	
Current Rank:	______________________	
Branch of Service:	______________________	
Yrs. in Service:	______________________	
Native Language:	______________________	
Other Languages Spoken:	______________________	
	______________________	
	Assignment	**Start and End Dates**
Military Assignments:	______________________	____________
Please list most recent to oldest for the past 10 years.	______________________	____________
	______________________	____________
	______________________	____________
	______________________	____________
	______________________	____________

Thank you very much for your time and effort!

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APPENDIX N WORKLOAD (TLX) QUESTIONNAIRE

A2C2 ESG-EXPERIMENT 11
Workload (TLX) Questionnaire

TEAM ID_________ **ROLE**_______ **DATE**______

Place an "X" along each scale at the point that best indicates the workload you experience during this time period. Note, a definition for each of the scales below is provided on page 2.

Mental Demand

Low High

Physical Demand

Low High

Temporal Demand

Low High

Performance

Low High

Effort

Low High

Frustration

Low High

A2C2 ESG-EXP1 5/30/2008

Demand Scale	Scale Endpoints	Scale Description
Mental Demand	*Low/High*	How much mental and perceptual activity was required (e.g., thinking, deciding, calculating, remembering, looking searching, etc.)? Was the task easy or demanding, simple or complex, exacting or forgiving?
Physical Demand	*Low/High*	How much physical activity was required (e.g., pushing, pulling, turning, controlling, activating, etc.)? Was the task easy or demanding, slow or brisk, slack or strenuous, restful or laborious?
Temporal Demand	*Low/High*	How much time pressure did you feel due to the rate or pace at which the tasks or task elements occurred? Was the pace slow and leisurely or rapid and frantic?
Performance	*Low/High*	How successful do you think you were in accomplishing the goals of the task set by the experimenter (or yourself)? How satisfied were you with your performance in accomplishing these goals?
Effort	*Low/High*	How hard did you have to work (mentally and physically) to accomplish your level of performance?
Frustration Level	*Low/High*	How insecure, discouraged, irritated, stressed, and annoyed versus secure, gratified, content, relaxed, and complacent did you feel during your task?

APPENDIX O TEAMWORK ASSESSMENT: OBSERVER RATING FORM

Aptima®, Inc. NPS

A2C2 ESG-EXPERIMENT 11
TEAMWORK ASSESSMENT: OBSERVER RATING FORM

TEAM ID__________ PART_________ DATE_______ OBSERVER__________

Instructions for Teamwork Ratings

Circle a number on the scale accompanying the questions on the following pages so that it best describes the behavior of the team you just observed. Consider each team separately. Try not to compare one team to another. Instead, strive to rate the behavior of a team on an absolute scale. To help you perform this absolute rating a brief description of the behavior you should observe for the highest rating on the scale and a brief description of the behavior you should observe for the lowest rating on the scale are provided for each question. Read these guides or anchors carefully and refer to them as you rate the team on each item. Feel free to write comments or explanations for any item.

The seven rating scales or questions for teamwork are organized into five areas. To further help you in your ratings each area is defined below. Please read these definitions carefully.

Communication Behavior

Communication involves the exchange of information between two or more team members in the prescribed manner and using proper terminology. Often the purpose of communication is to clarify or acknowledge the receipt of information.

Monitoring Behavior

Monitoring refers to observing the activities and performance of other team members. It implies that team members are individually competent and that they may subsequently provide feedback and backup behavior.

Back-up Behavior

Backup behavior involves assisting the performance of other team members. This implies that team members have an understanding of other members' tasks. It also implies that members are willing to give and seek assistance.

Coordination Behavior

Coordination refers to team members' executing their activities in a timely and integrated manner. It implies that the performance of some team members influences the performance of other team members. This may involve an exchange of information that subsequently influences another member's performance.

Team Orientation

Team orientation refers to the commitment team members exhibit to working together. It implies that they place the goals and interest of the team ahead of their personal goals. It also refers to the trust each team member has in the other team members, team pride, and esprit de corps.

A2C2 ESG-EXP11 1 5/30/2008

Communication Behavior

1. To what extent were errors caused by inadequate team communication?

1 2 3 4 5

7 Communication within the team was always effective and never responsible for errors or inefficient performance.

1 Communication was wholly inadequate and resulted in inefficient performance and many of the errors made by the team.

2. To what extent did team members provide relevant information to another team member, in a pro-active way, without that team member having to ask for it?

1 2 3 4 5

7 Team members always provided important information to others without being asked.

1 Team members never provided information to others unless specifically asked.

Comments: ______________________________

Monitoring Behavior

3. To what extent did team members alert each other to impending decisions and actions?

1 2 3 4 5

7 Team members always alerted each other to impending decisions and actions; supporting information was actively solicited from other team members.

1 Team members did not keep each other informed of impending decisions and actions; compromises to mission safety or mission effectiveness arose when a team member waited for the other to volunteer significant information.

Comments: ______________________________

Back-up Behavior

4. To what extent did team members anticipate the need to provide assistance to other team members?

1 2 3 4 5

7 Team members consistently anticipated the need to provide assistance to others during critical phases of the mission.

1 Team members never anticipated the need to provide assistance to others during critical phases of the mission; the others always had to ask.

Comments: ______________________________

5. Did the team members adjust individual task responsibilities to prevent overload?

1 2 3 4 5

7 Team members were consistently aware of each other's workload building and reacted quickly to adjust division of task responsibilities to redistribute workload.

1 Team members were generally unaware of each other's workload building; little or no attempt was made to adjust the distribution of task responsibilities before significant compromises to mission safety or mission effectiveness occurred.

Comments: ____

Coordination Behavior

6. To what extent was the team's behavior coordinated?

1 2 3 4 5

7 Good coordination behavior occurs when team members consistently pass critical information to the other members, thereby enabling them to accomplish tasks; members consistently carry out tasks quickly or in a timely manner enabling others to carry out their tasks effectively. Team members appear very familiar with the relevant parts of one another's jobs and carry out individual tasks in a synchronized manner.

1 Poor coordination behavior occurs when team members consistently carry out their tasks ineffectively, leading to other team members' failing at their tasks; members carry out their tasks unpredictably, leading to delays in execution of critical tasks; members neglect to pass on critical pieces of information to one another, leading to breakdowns in team performance; team members carry out their tasks with significant delays leading to team errors.

Comments: ____

Team Orientation

7. How congruent/similar were the team members' understanding of the mission?

1 2 3 4 5

7 Team members were completely in agreement (i.e., congruent) on goals, tasks, and concepts involving the mission.

1 Team members were rarely in agreement (i.e., congruent) on goals, tasks, and concepts involving the mission.

Comments: ____

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APPENDIX P A2C2 ESG POST-EXPERIMENT SURVEY

A2C2-ESG Mar 08 TEAM ________ ROLE: ________

A2C2 ESG POST-EXPERIMENT SURVEY

1. How effective was your team's original plan?

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ______________________________

____

____

2. How effective was your team's planning *process*?

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ______________________________

____

____

3. How effective were you in being able to dynamically re-plan?

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ______________________________

____

____

4. How useful was the feedback on your performance in helping you to re-plan? (e.g., to know when you were falling behind in obtaining ISR measurements)

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ______________________________

____

____

1

5. What impediments did you experience regarding re-planning? (please be as specific and complete as you can.)

Comments: ____

____

____

6. How effective were you in being able to implement the plan you developed?

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ____

____

____

7. What impediments did you experience regarding implementing the plan you developed?

Comments: ____

____

____

8. What is your overall assessment of your team's performance?

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ____

____

____

9. What did your team do well? ______________________________

____

____

10. What could your team have done differently to improve performance? ____________

____

____

____

11. How well did the team as a whole act in support of others?

1	2	3	4	5	6	7
Not at All	Very Ineffective	Somewhat Ineffective	Midpoint	Somewhat Effective	Very Effective	Extremely Effective

Comments: ____

____

____

12. What could have been done to improve your team's performance?

Comments: ____

____

____

13. If there were a loss of an additional UAV and one MSPF, please indicate the degree to which you think it would cause a decline in performance.

1	2	3	4	5
No Impact on Performance	Some Impact	Significant Impact	Disastrous Impact on Performance	Could Not Accomplish Mission

Please explain your rating:

____

____

____

14. Any other comments? ____

____

____

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